CHAPTER 3
AFFECTED ENVIRONMENT

INTRODUCTION

This chapter describes existing conditions for resource areas (water quality, fisheries, amphibians, soils, wildlife, vegetation, human health, recreation and wilderness) within the National Forest that may be affected by the proposed action. For each resource area, there will be a description of the relevant regulatory requirements, the analysis area, the method used in the analysis, and the affected environment. More detailed information on each resource can be found in the resource specialist's reports in the project file.

FOREST PLAN MANAGEMENT DIRECTION

Management direction for the Gallatin National Forest is found in the 1987 Gallatin National Forest Plan. The following summary highlights the management direction relevant to this proposal. Goals and standards found in the Forest Plan relevant to the proposed action include:

- Manage National Forest resources to prevent or reduce serious long lasting hazards from pest organisms utilizing principles of integrated pest management (Gallatin Forest Plan, Forest-wide Goal, page II-1).

- Noxious weeds along roads and trails will be treated page (Gallatin Forest Plan, Forest-wide Standard, page II-27).

- Implement an integrated weed control program in cooperation with the state of Montana and County Weed boards to confine present infestations and prevent establishing new areas of noxious weed. Noxious weeds are listed in the Montana Weed Law and designated by County Weed Boards. Integrated Pest Management, which uses chemical, biological, and mechanical methods, will be the principal control method. Spot herbicide treatment of identified weeds will be emphasized. Biological control methods will be considered as they become available. Funding for weed control on disturbed sites will be provided by the resource which causes the disturbance (Gallatin Forest Plan, Forest-wide Standard, page II-28).

Management area goals, objectives and standards relevant to the proposed action:

Management area descriptions are found in Chapter 3 of the Gallatin Forest Plan. These descriptions provide specific goals and management direction to achieve the Forest-wide goals and standards found in Chapter 2 of the Forest Plan. Proposed actions will occur on nearly all management area allocations identified in the Forest Plan. None of the management areas restrict the control of noxious weeds. Some management areas, however, restrict motorized access. The Forest Service may use motorized vehicles to apply weed control in closed areas when necessary, by obtaining variance. Steps will be taken to minimize tracks, by staying on established tracks. Weed control methods will comply with motorized restrictions in wilderness areas and Research Natural Areas.

AGENCY POLICY AND DIRECTION

Important policy and direction relevant to weed control is given in the Chief's Natural Resource Agenda (1998), the Northern Region Overview, and the Forest Service Manual.

1988 Natural Resource Agenda. In March of 1998, Forest Service Chief Mike Dombeck presented the Agency's emphasis in management direction for the 21st century. In this Agenda was a strong emphasis on conserving and restoring degraded ecosystems, including actions to "attain desirable plant communities", and "prevent exotic organisms from entering or spreading in the United States."

Forest Service Manual 2259.03. "Forest office shall cooperate fully with State, County and Federal officials in implementing 36 CFR 222.8 and sections 1 and 2 of PL 90-583 (see below). Within budgetary constraints, the Forest Service shall control to the extent practical, noxious farm weeds on all National Forest System lands."

LAWS AND REGULATIONS

The following laws and regulations give both broad and specific authority and direction for control of noxious weeds on National Forest system lands:

Executive Order 13112. Invasive Species, February 3, 1999. This order directs Federal Agencies whose actions may affect the status of invasive species to (l) prevent the introduction of invasive species (ii) detect and respond rapidly to, and control, populations of such species in a cost-effective and environmentally sound manner, as appropriations allow.

36 CFR Sub A, Sec 222.8. "… The chief, of the Forest Service, will cooperate with County or other local weed control Districts in analyzing noxious farm weed problems and developing control programs in areas which the National Forest and National Grasslands are a part."

Federal Noxious Weed Act of 1974 (sec 9) authorized the Secretary to cooperate with other Federal and State agencies or political subdivisions thereof, and individuals in carrying out measures to eradicate, suppress, control or prevent the spread of noxious weeds.

Public Law 90-583 (Carlson-Foley Act, October 17, 1968). Authorized and directs heads of Federal Departments and Agencies to permit control of noxious plants by State and local governments on a reimbursement basis in connection with similar and acceptable weed control programs being carried out on adjacent non-Federal land.

Public Law 94-579 (The Federal Land Policy and Management Act of 1976). This act provides authority to control weeds on rangelands as part of a rangeland improvement program.

Public Law 94-588 (The National Forest Management Act of 1976). This act provides authority for removal of deleterious plant growth and undergrowth and provides for expenditures of funds to serve as a catalyst to encourage better management of private forests and rangelands.

The State of Montana County Noxious Weed Management Act provides for designation of noxious weeds within the State and directs control efforts. Provisions are made for registration of pesticides, licensing of distributors and applicators, and enforcement of State statutes. An

enforcement responsibility for the control of noxious weeds within Montana is delegated to County Commissioners through Weed Management District Boards.

ENVIRONMENTAL JUSTICE

Executive Order 12898, issued in 1994 ordered Federal agencies to identify and address any adverse human health and environmental effects of agency programs that disproportionately impact minority and low-income populations. At this time, no minority or low-income communities have been identified in southwest Montana.

NATIVE AMERICAN TREATY RIGHTS

While the alternatives may have differing impacts on wildlife and fish, as described in Chapter 4, none of the alternatives would alter opportunities for subsistence hunting, fishing, and plant gathering by Native American tribes. Tribes holding treaty rights on the Gallatin National Forest were contacted during this EIS process and they did not express a concern regarding this project.

VEGETATION

Regulatory Framework -Vegetation

The previous section (Agency Policy and Direction; and Law and Regulations) discussed the regulations that pertain to weeds.

Forest Service Manual 2670.22 Sensitive species, provides the following direction for sensitive plants:

- Develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions.
- Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands.
- Develop and implement management objectives for populations and/or habitat of sensitive species.

Affected Area – Vegetation

The analysis area for vegetation includes all vegetation communities in proximity to proposed treatment areas. These plant communities have the potential to be directly or indirectly impacted by weeds and proposed treatment methods.

Analysis Method - Vegetation

Information used came from data on file at the Gallatin National Forest, literature review, and personal communications with resource specialists with knowledge of vegetation, weed control, and herbicide effects. Acreage values were derived utilizing GIS.

The following technique was used to evaluate the different alternatives and their impacts on sensitive plants. First, all known sensitive plants and invasive plant locations have been mapped. Sites having both types of plants within 500 feet were identified as high-risk areas. The 500 feet

distance intended to include sites that may become infested with weeds in the near future. Next, each alternative was evaluated for effectiveness of treatment based on the following criteria: will the site be treated under this alternative; will the treatment stop the spread of weeds into the area with sensitive plants; and will the treatment have a detrimental impact on the sensitive plants.

Affected Environment - Vegetation

Components of the affected vegetation are the weed species themselves, and the native plants communities. The vegetation information is presented in three sub-sections:

Weed Species (Invasive and Noxious)
Native Plant Communities
Rare Native Plant Species

Twenty-seven plant species are currently listed as Montana state category 3 (New Invader), 2 (Rapid Spreading), or 1 (Wide Spread) noxious weeds. At least one of the five counties (Madison, Gallatin, Park, Sweet Grass, or Carbon) within the Forest identified twelve additional county category 4 (New Invader) noxious weeds, five watch species of concern, and four species currently monitored as not a concern. Of the total combined 46 concern species listed, 28 have actually been located and mapped on the Forest. Tables 3-1 and 3-2 display the acreage for each of these weed species. Canada thistle, spotted knapweed, hounds tongue, and musk thistle are the predominant noxious weed species, comprising 59 percent or 7,748 net acres. Cheatgrass, the predominant invasive species mapped, involves 17 percent or 2,202 of the total mapped acres.

A majority of these sites have a high component of cheatgrass. Macrobiotic crusts once occupied much of the inter-space between perennial shrubs and grasses. Excessive soil disturbing activities, such as trampling by ungulates, over the past 100 years combined with the introduction of highly invasive plants has slowly concerted the inter-space to thick sagebrush-cheatgrass communities. Cheatgrass is exceptionally competitive which makes it difficult for indigenous perennials to pioneer into the cheatgrass environment. Many of the cheatgrass communities throughout the country, especially the drier sites, are slowly changing to more perennial European type weeds that have the ability to expand in size exponentially each year. The Gallatin National Forest could experience a massive invasion of knapweed, leafy spurge, Dalmatian toadflax, and/or yellow toadflax in the very near future. As tougher deep tap rooted perennial plants become established, the expense for grassland rehabilitation increases significantly. Attempts to replace cheatgrass with perennial grasses have been difficult, especially where grazing continues to occur. The best success of out-competing cheatgrass has involved the seeding of crested and Siberian wheatgrasses (Personal communication, S. McDonald at Circle S Seed, and P. Hoppe at Gardiner Ranger District). Efforts to remove cheatgrass will require filling the inter spaces between the plants. This requires seeding shallow rooted species such as sandbergs bluegrass, Sherman big bluegrass, or covar sheep fescue in addition to the crested and Siberian wheatgrasses. The perennial plant cover in a stand of cheatgrass is generally less than five percent. A successful weed treatment seeding would occur if the perennial species establish a groundcover of 15 to 25 percent.

The remaining 23 weed species, of varying densities, grow on the remaining 24 percent or 3,148 mapped acres. The acres identified are by species and not by overall infestation area. Due to some sites having multiple weed species the actual infested acreage may in be slightly overestimated and include some private land in-holdings.

Table 3-1. Category 3, 2, and 1 Weed Acreage on the Gallatin National Forest (infested acres not gross).

	District/Forest Acres						Treatment Priority:
	D-1	D-2	D-3	D-6	D-7	Total	
Category 3 (New Invader):							
Yellow Starthistle						0	1
Common Crupina						0	1
Rush Skeletonweed						0	1
Yellow Flag Iris						0	1
Eurasian Watermilfoil						0	1
Sub Total	**0**	**0**	**0**	**0**	**0**	**0**	
Category 2 (Rapid Spreading):							
Dyers Woad					0.1	0.1	1
Purple Loosestrife						0	1
Tansy Ragwort						0	1
Meadow Hawkweed Complex				0.3		0.3	1
Orange Hawkweed					1.6	1.6	1
Tall Buttercup						0	1
Tamarisk						0	1
Perenial Pepperweed						0	1
Sub Total	**0**	**0**	**0**	**0.3**	**1.7**	**2**	
Category 1 (Wide Spread):							
Canada Thistle	211	730	145	852	164	2102	3,5
Field Bindweed		0.4			0.7	1.1	2
Whitetop or Hoary Cress		3		7	0.1	10.1	1
Leafy Spurge	173	68		98	2.3	341.3	1,3,5
Russian Knapweed		0.1			0.2	0.3	1
Spotted Knapweed	21	185	230	485	820	1741	1,3,5
Diffuse Knapweed					0.9	0.9	1
Dalmatian Toadflax	2	5	445	0.01	0.4	452.41	1,3,5
St. Johnswort (Goatweed)		1		12	0.5	13.5	1
Sulfur (erect) Cinquefoil	9	0.2		37	3.3	49.5	1
Common Tansy		15		87	1.3	103.3	2
Oxeye Daisy	124	5		161	35	325	1,3,5
Houndstongue	196	489	382	1160	94	2321	1,3,5
Yellow Toadflax	3	15		15	748	781	1,3,5
Sub Total	**736**	**1501.7**	**1202**	**2899.01**	**1122.7**	**7461.41**	
Total	**736**	**1501.7**	**1202**	**2899.31**	**1124.4**	**7463.41**	

Table 3-2. Category 4 Noxious Weed, Watch Species, and Invasive Species Acreage on the Gallatin National Forest.

	Weeds on National Forest by County											Forest Treatment Priority
	Sweet Grass		Meagher		Park		Gallatin		Madison		Total Acres	
	Key	Acres	Key+	Acres	Key	Acres	Key	Acres	Key	Acres		
Meadow Knapweed	W	0	C-3	0	N.A.	0	C-4	0.3	N.A.	0	**0.3**	1
Musk Thistle	C-4	148	C-1	6.7	C-4	431	C-4	928	C-4	70.5	**1584.2**	1,3,5
Poison Hemlock	N.A.	0	C-2	0	C-4	0	C-4	9	N.A.	1.3	**10.3**	1,3,5
Common Burdock	N.A.	0	C-1	0	C-4	0.1	N.A.	0.1	C-4	0	**0.2**	2,4
Common Mullein	N.A.	68	C-1	0	C-4	22	N.A.	69	C-4	43	**202**	2,4
Common Cocklebur	N.A.	0	W	0	C-4	0	N.A.	0	N.A.	0	**0**	2,4
Bull Thistle	C-4	0	W	0	W	79	N.A.	0.1	N.A.	4.5	**83.6**	2,4
Black Henbane	N.A.	0	C-1	0	W	3	W	0	C-4	0	**3**	2,4
Common Teasel	N.A.	0	W	0	N.A.	0	N.A.	0	C-4	0	**0**	2,4
Field Scabious	W	0	C-2	0	N.A.	0	W	3.4	C-4	1.6	**5**	1
Catch Weed Bedstraw	N.A.	0	W	0	W	0	W	0	N.A.	0	**0**	2
Meadow Sage (Salvia)	N.A.	0	W	0	N.A.	0	W	0	N.A.	0	**0**	4
Cheat Grass	N.A.	145	N.A.	0	N.A.	2057	N.A.	0	N.A.	0	**2202**	4
Golden Chamomile	N.A.	0	W	0	W	0	N.A.	0	N.A.	3	**3**	2,4
Plumeless Thistle	N.A.	0	N.A.	0	W	0.1	N.A.	0	N.A.	0.7	**0.8**	2,4
Woodland Sage	W	0	N.A.	0	N.A.	0	N.A.	0	N.A.	0	**0**	2,4
Hoary Allyssum	N.A.	0	N.A.	0	N.A.	0	N.A.	0	N.A.	1500	**1500**	3,5
Perrenial Sowthistle	N.A.	0	C-1	0	N.A.	0	N.A.	0	N.A.	0	**0**	2
Absinth Wormwood	N.A.	0	C-2	0	N.A.	0	N.A.	0	N.A.	0	**0**	2
Scentless Chamomile	N.A	0	N.A	0	N.A	0	N.A	0	N.A	40.5	**40.5**	2
White Bryony	N.A	0	N.A	0	N.A	0	N.A	0	N.A	0	**0**	2
C-4 Total		**148**		**6**		**453**		**937**		**115**	**1660**	
W Total		**0**		**0**		**3**		**3**		**40**	**47**	
N.A. Total		**213**		**0**		**2136**		**69**		**1509**	**3927**	
Grand Total		**361**		**6**		**2592**		**1009**		**1665**	**5634**	

Key

C-4 = Category 4, New Invader
C-3 = Category 3, New Invader
C-2 = Category 2, Rapid Spreading
C-1 = Category 1, Wide Spread
W = Watch List
N.A. = Not A Concern

+ (Meagher County breaks C-4 further, ie. C--3, C-2, or C-1):

Figure 2-1, located in Chapter 2, depicts weed treatment priorities commonly utilized on the Gallatin National Forest due to a shortage of funding and effectiveness potential. Priority is generally given to those new populations of aggressive invader species where long-term management can be successful. An example would be a new site consisting of 5 plants of yellow star thistle that have not been allowed to produce viable seed yet. On larger, well established infestations, such as 20 acres of leafy spurge, where long term effectiveness is questionable, containment strategies play a much more important role. Even then control emphasis is provided along the spread vector areas such as trailheads, roadways, and parking areas. Tables 3-1 and 3-2 denote the combination of treatment priorities each weed species may need. Table 3-5 denotes the potential spread of some of the more concern weeds.

Biological control is becoming more important where actual eradication or control is not likely. Our best defense has been one of attacking weeds from every angle possible. Table 3-3 depicts the various biological control agents that have been released on the Gallatin Forest to date. While some agents have reduced weed densities by as much as 30 to 40 percent, none have eliminated a weed completely. Some agents require a number of years to become established and have a significant effect on weed populations. Efforts to establish insectaries will continue as the biological control program develops more options.

Table 3-3. Biological control agents released on the Gallatin Forest.

Weed	Biological Control Agent	Number of Release Sites by Ranger District				
	Scientific Name	**Big Timber**	**Livingston**	**Gardner**	**Bozeman**	**Hebgen**
Canada Thistle	*Ceutorhynchus litura*				1	1
	Cassida rubiginosa					
	Urophora cardui		1			
Leafy Spurge	Aphthona flava		1			
	Aphthona nigriscutis	14	2		23	
	Aphthona lacertosa	20	2		15	2
	Aphthona czwalinae	17	2		15	2
	Apthhona cyparissiae	4				
	Oberea erythrocephala					
	Spurgia esulae					
St. Johnswort	*Chrysolina quadrigemina*					
	Aplocera plagiata					
Knapweed	*Larinus obtusus*					
	Cyphocleonus achates					4
	Larinus minutus					1
	Agapeta zoegana				2	1
	Sclerotinia (fungus)					1
Yellow and	*Mecinus janthinus*			2		6
Dalmatian	*Brachypterolus pulicarius*					
Toadflax	*Gymnetron antirrhini*					

Weed	Biological Control Agent	Number of Release Sites by Ranger District				
	Scientific Name	**Big Timber**	**Livingston**	**Gardner**	**Bozeman**	**Hebgen**
	Calophasia lunula			2		
Poison Hemlock	*Agonopterix alstroemeriana*					
Musk Thistle	*Trichosirocalus horridus*					
	Cassida rubiginosa					

Native Plant Communities:

The 1.8 million acres of Gallatin National Forest land supports a very diverse mixture of plant communities. Vegetation runs from open, dry grasslands and sagebrush/grass in the valley bottoms, to dense lodgepole, subalpine fir and Douglas fir forest in the mid elevations. Subalpine/alpine grasslands, tundra and rock barrens dominate the high elevations. Wetlands and riparian areas are scattered throughout the Forest. Table 3-4 show a breakdown of existing habitat types for the forest and the amount of weeds present. Based on the data available 27.8 percent or roughly 500,000 acres is naturally susceptible or at high risk to weed invasion.

Table 3-4. Weed Occurrence by Habitat Type on the Gallatin National Forest.

Primary Habitat Type Code	Total Acres on Forest	Percent of Forest	Number of Instances Associated with Weed Polygons	Average Acres	Total Acres	Percentage of Total
UNCLASSIFIED	23,006	1.1	40	0.49	19.42	0.00
ABLA-PIAL/VASC	34,426	1.6	22	1.59	35.01	0.00
ABLA/CARU	33,735	1.6	18	0.80	14.35	0.00
ABLA/GATR, VAGL	75,360	3.5	77	2.36	181.57	0.01
ABLA/LIBO	67,894	3.2	146	1.06	155.44	0.01
ABLA/VAGL	15,202	0.7	259	1.39	358.93	0.03
ABLA/VAGL, ARCO	18,160	0.8	16	0.78	12.54	0.00
ABLA/VAGL, PICEA/GATR	15,994	0.7	257	1.71	439.36	0.03
ABLA/VAGL, LIBO	564,340	26.3	31	0.83	25.76	0.00
ABLA/VASC	14,414	0.7	**823**	**1.41**	**1159.74**	**0.09**
ABLA/VASC, LIBO	17,425	0.8	9	0.32	2.85	0.00
ABLA/VASC, ABLA/VAGL	309,745	14.4	20	1.95	39.09	0.00
ARAR/FEID, ARTR/FEID	6,719	0.3	73	6.08	443.92	0.03
ARTR/AGSP	7,420	0.3	**415**	**4.47**	**1853.56**	**0.14**
ARTR/FEID	79,544	3.7	**1403**	**2.85**	**3995.95**	**0.30**
DECA/CAREX	16,077	0.7	190	2.51	475.95	0.04
FEID-AGSP	33,644	1.6	**1338**	**4.37**	**2204.40**	**0.17**

Primary Habitat Type Code	Total Acres on Forest	Percent of Forest	Number of Instances Associated with Weed Polygons	Average Acres	Total Acres	Percentage of Total
FEID/AGCA	109,767	5.1	15	1.46	21.85	0.00
FEID/DECA	434,875	20.3	131	3.57	467.55	0.04
PICO/PUTR	6,736	0.3	**245**	**2.74**	**672.04**	**0.05**
PSME/FEID	25,254	1.2	226	1.02	231.61	0.02
PSME/PHMA	93,285	4.3	46	2.12	97.68	0.01
PSME/SYAL	49,645	2.3	253	1.47	372.60	0.03

Some plant species can be considered an undesirable even though they are native to the area. Tall larkspur, especially where conditions support it becoming a major component of the landscape, can be poisonous to cattle. Management of these sites often occurs where significant poisoning occurs. Sheep grazing, fertilizing, and grazing avoidance during the early summer months, and herbicides have all proven effective.

Since the late 1800's exotic plant species have been spreading across the Pacific Northwest. It's clear when studying distribution records of exotic plant species over time that the plants are increasing and expanding their range once they are established (Rice 1999). Based on these historic trends, we expect that these patterns of expansion will continue due to transport of seeds from increasing intercontinental travel and trade, and through continued disturbance on all lands (through agricultural, residential, recreational, and commercial developments). Nationally, Forest Service lands have an estimated six to seven million acres that are infested with noxious or invader weeds. This figure is increasing at an exponential rate of 8-12 percent per year. For example, 10 acres of spotted knapweed left unmanaged today in a disturbed environment has the potential of increasing to 1,000 acres in ten years. Risk assessments are complete for 12 weeds occurring on the Forest using the assessment protocols developed by Maria Mantas for the state of Montana (http://www.fs.fed.us/r1/cohesive_strategy/datafr.htm). Table 3-5 quantifies the acreage at risk of invasion if the current weed populations are allowed to grow unchecked. Many of the associated sites are already infested with early pioneering plant species making them prime candidates for weed spread.

Table 3-5. Acres on the Gallatin at Risk to Invasive Weeds, without Disturbance.

	High Risk	Moderate Risk	Low Risk	Unknown Risk	No Risk
Whitetop	31,886	0	126,336	1,270,140	673,131
Spotted knapweed	428,804	0	360,308	0	1,312,382
Canada thistle	7,497	0	498,894	0	1,595,102
Hounds tongue	0	0	213,170		1,495,818
Leafy spurge	429,136	0	71,439	0	1,600,919
Orange hawkweed	169,769	125,605	59,864	81,025	1,665,228
St. Johnswort	219,881	1,597	414,509	53,146	1,394,362
Dyers woad	396,536	9,238	0	56,430	1,639,289
Field scabious	146,713	27	0	1,528,257	426,497
Dalmatian toadflax	404,669	0	71,782	17,867	1,607,174

	High Risk	Moderate Risk	Low Risk	Unknown Risk	No Risk
Yellow toadflax	112,879	429	395,781	70,417	1,521,987
Sulfur cinquefoil	310,999	31	424,351	22,776	1,343,336

Ground disturbing catastrophic events, such as a wild fire, create an environment most prone to the spread of noxious weeds. Weeds typically establish most quickly on previously forested areas having burnt under high intensity and high severity conditions. Prior to the fires of 2000, shading by conifers inhibited noxious weeds from spreading into areas with unburned overstories. With the overstory forest canopy having been lost very little understory vegetation exists to compete with weeds. Post-fire monitoring suggests that there may be an increase in the number of weeds, especially spotted knapweed and Dalmatian toadflax following the fires. The Douglas-fir habitats in the Fridley Burn area of the Livingston Ranger District and the Purdy Burn of the Bozeman District are probably most prone to long-term invasion

The threat of the weeds occurring on the Gallatin National Forest developing a resistance to the herbicides has not been documented to date. However, the likelihood of this happening does exist. One of the best ways of preventing herbicide resistant weeds from occurring is to rotate the herbicides used on each site from one year to the next. As an adaptive management approach, herbicide rotation will be considered where resource management objectives can still be met. Rotating herbicides by chemical family and preferably by mode of action would minimize the potential development of herbicide resistant weeds. Table 3-6 depicts the modes of action and family name for some of the more commonly used rangeland herbicides.

Table 3-6. Commonly Used Herbicides.

Mode of Action	Chemical Family	Common Name	Trade Name	Weed Spectrum	Soil Residual
EPSP synthesis inhibitor (Blocks protein synthesis)	Glyphosate	Glyphosate-ipa	Roundup, Rodeo, Accord, Glyphomate	Non-selective	No
ALS inhibitors (Blocks protein synthesis)	Imidazolinones	Imazapic	Plateau	selective	Yes
		Imazapyr	Arsenal	Non-selective	Yes
	Sulfonylureas	Chlorsulfuron	Glean, Telar	Broadleaf species	Yes
		Metsulfuron	Ally, Escort	Broadleaf species	Yes
		Sulfometuron	Oust	Broadleaf species (Mustards)	Yes
Synthetic auxins (Growth regulator)	Phenoxy acetic acids	2,4-D	2,4-D, Curtail*, Aqua-Keen	Broadleaf species	No
	Benzoic acid	Dicamba	Banvel, Clarity	Broadleaf species	Yes
	Pyridines	Clopyralid	Transline, Redeem* Curtail*	Compositeae, Polygonaceae, Fabaceae, Solanaceae	Yes

Mode of Action	Chemical Family	Common Name	Trade Name	Weed Spectrum	Soil Residual
		Picloram	Tordon 22K	Broadleaf species	Yes
		Triclopyr	Garlon, Redeem* (Garlon 4)	Trees and Brush	No

* Curtail and Redeem are a mix of Clopyralid and Triclopyr.

Additional herbicide support may be found in the Nature Conservancy guide: http://tncweeds.ucdavis.edu/handbook.html

Rare Native Plant Species:

Habitat for 21 sensitive plants may exist on the Gallatin National Forest. Most of the listed sensitive plant species are located in alpine, subalpine or moist areas. Of the 21 species, four species have been located on the National Forest: large-leaved balsamroot *(Balsamorhiza macrophylla);* slender paintbrush *(Castilleja gracillima);* discoid goldenweed (*Haplopappus macronema var. macronema); and* Wolf's willow *(Salix wolfii var. wolfii).* It is possible that Jove's buttercup (*Ranunculus jovis)* is present but not detected in the surveys due to the plant physiology at the time of year when the surveys were conducted (Jove's buttercup completes it's life cycle in early summer and surveys often occur in mid summer). Currently there are 45 known sites that contain sensitive plants, six of these sites also contain invasive plants. For these sites both the weeds and the method of controlling the weeds can impact the sensitive plants.

Plants listed as sensitive by the Gallatin National Forest are described in Table 3-7 (Lesica and Shelly 1991, pages 12-13, 16-17, 21, 23, 26, 29, 34, 36-37, 39, 47, 49-51, 53, 56, and 58).

Table 3-7. Description of sensitive plant habitat.

Species	Habitat	Habitat Present
Adoxa moschatellina Musk-root	Grows in moist, mossy areas often in rock crevices and boulder slopes that may provide protection from human activities from 4,400-5,400 feet.	Yes
Aquilegia brevistyla Small-flowered Columbine	Found in meadows, open woods and rock crevices with limestone soils from 5,000-6,000 feet.	Yes
Balsamorhiza macrophylla Large-leaved Balsamroot	Grows on open hills at 7,000-8,500 feet. Associated with bunch grasses. Generally flowers and seeds late June through early August. Two sites have been located on the forest.	Yes
Carex livida Pale sedge	In Montana, grows in spagnum bogs and fens from 4,000-6,000 feet.	Yes
Castilleja gracillima Slender Paintbrush	Located in wet meadows and along stream banks and other riparian areas from 6,700-7,000 feet. Flowers late June through late August. Numerous sites located on the Forest.	Yes
Cypridium calceolus var. parviflorum Small Yellow lady's-slipper	Occurs in damp woods, bogs, mossy seeps and moist forest-meadow ecotones from 3,000-6200 feet.	Yes
Drosera anglica English Sundew	Found in sphagnum bogs at mid-elevations in the mountains.	Yes
Eleocharis rostellata Spike Rush	Grows in bogs.	Yes

Species	Habitat	Habitat Present
Epipactis gigantea Giant Helleborine	In Montana, occurs only around thermal springs, perennial springs with year-round water flow, bogs and fens, and seeps from 2,000-5,750 feet.	Yes
Eriophorum gracile Cotton Grass	Occurs in bogs at lower elevations.	Yes
Gentianopsis simplex Hiker's Gentian	Found growing in mountain bogs, meadows and seepage areas from 4,400-8,400 feet. Flowers in July and August.	Yes
Goodyera repens Northern Rattlesnake-plantain	Grows in cool north aspects characterized by spruce/twinflower or subalpine-fir/twinflower habitat types. Flowers in August.	Yes
Haplopappus macronema var. macronema Discoid Goldenweed	Generally found growing at or above timberline (usually above 7,640 feet) in rocky, open or sparsely wooded slopes and often in talus slopes. Flowers in late July and August. Two sites have been located on the forest.	Yes
Juncus hallii Hall's Rush	Associated with montane to subalpine meadows, moist to dry meadows and slopes between 6,900-8,400 feet. Flowers in July and August.	Yes
Polygonum douglasii var. austiniae Austin's knotweed	Grows on open, gravelly, often shale-derived soil with eroding slopes and banks from 5,800-6,600 feet.	Yes
Ranunculus jovis Jove's buttercup	Occurs on sagebrush slopes and open areas in spruce/fir parklands from 7,500-9,500 feet. Flowers and seeds generally set in May or June.	Yes
Salix barrattiana Barratt's willow	Found growing in cold, moist soils near or above treeline (6,800-10,500 feet) especially in alpine areas. Fruits in late July or August.	Yes
Salix wolfii var. wolfii Wolf's willow	Grows along streambanks and in wet meadows generally from 8200-9000 feet. Numerous sites located on the Forest.	Yes
Shoshonea pulvinata Shoshonea	Grows on open, windswept limestone substrates (in thin, rocky soils) along ridges and canyon rims from 6,800-9,000 feet. Blooms in late June through July.	Yes
Thalictrum alpinum Alpine Meadowrue	Occurs in montane and subalpine habitat on hummocky ground where shrubs are present. Moist, alkaline meadows from 6,500-7,000 feet. Generally flowers and sets seeds in May and June.	Yes
Veratrum californicum California false-helleborine	Found growing in wet meadows and along stream banks in montane and subalpine habitat; 5,000-8,500 feet. Flowers in July and August.	Yes

Below is a description of the six sites that contain both sensitive plants and invasive plants. Two sites involve *Salix wolfii* (a willow species): one site has an adjacent patch of spotted knapweed; and the other site has Canada thistle. Another site has both *Balsamorhiza macrophylla* and Canada thistle. On this site *Balsamorhiza* (which has a root tuber) and Canada thistle (which spreads by both wind disseminated seeds and rhizomes) may have a considerable amount of competition between the two species. On two other sites, one has *Haplopappus macronema* and the other *Castilleja gracillima*, both are at risk of being invaded by yellow toadflax, spotted knapweed, and scentless chamomile. In numerous locations throughout the Hebgen Basin yellow toadflax has formed dense patches to the point of excluding native plants. Finally, the last site has *Castilleja gracillima* and houndstounge. Since *Castilleja gracillima* is rhizomatous, and houndstoungue has a taproot, and both plants have similar size; it is reasonable to assume that the *Castilleja* will compete well with the houndstoungue, and is not at risk.

In addition, the Horse Butte area and Hebgen Dam areas have *Mimulus nanus* and possibly *Mimulus breviflorus.* Although these plants are not currently on the Gallatin National Forest Sensitive Plant list, they are listed as species of concern in Montana according to the Montana Heritage Program (http://nhp.nris.state.mt.us/plants/index.html). The Horse Butte site does not have weeds adjacent to the rare plants, but the Hebgen Dam site does have knapweed in close proximity.

SOILS AND GROUND WATER

Regulatory Framework - Soils

The National Forest Management Act requires that lands be managed to ensure the maintenance of long-term soil productivity, soil hydrologic function, and ecosystem health. Soil resource management will be consistent with these goals.

The Forest Service Manual (FSM) 2550 – Soil management has a goal to optimize sustained yield of goods and services without impairing the productivity of the land, and it is the policy of the Forest Service to manage land in a manner that will improve soil productivity.

Other laws and guidance include the Soil Conservation and Domestic Allotment Act (16 USC 590) that states soil erosion is a menace to national welfare. This Act provides for the prevention of erosion on lands owned or controlled by the United States through a variety of means including the establishment of vegetative cover. In addition, Congress declares that unsatisfactory conditions on public lands present a high risk of soil loss, subsequent loss of productivity, and unacceptable levels of siltation that can be mediated by increasing rangeland management (43. CFR §1901).

Affected Area – Soils and Ground Water

Affected areas for the impact analysis of proposed actions on soil quality are weed-infested sites currently under consideration for spray with herbicides. Noxious weeds currently occur on approximately 12,600 acres on the Gallatin National Forest. (Map and data tables are located in the project file, Gallatin Forest Weeds Inventory.)

Noxious weeds occur on most combinations of landforms, geology, and soil in the foothills to midmontane elevation zones. Often, darker colored soils having relatively high organic matter levels occur in conjunction with weeds. These soils are generally associated with lower elevation vegetation types having a grass or shrub component. (Davis and Shovic, 1984.)

Analysis Method - Soils and Ground Water

Impacts on soil quality resulting from weed infestation and weed control measures were incorporated by reference from other recent weed EIS (as discussed below). To asses impacts to ground water quality, the RAVE (Relative Aquifer Vulnerability Evaluation) model use used (developed by Montana State University Extension Service, 1990). GIS (Geographic Information System) incorporate the RAVE model, herbicide soil mobility rate, the Gallatin National Forest soil surveys, distance to water, and topographic position. The GIS maps allowed for a landscape analysis so that areas with low to unacceptable risk of groundwater contamination could be identified. See Appendix E for more details of this analysis process and landscape level maps.

Several major factors in a particular area determine the relative vulnerability of ground water to pesticide contamination. Nine of these factors were incorporated into the RAVE score card and are defined below and in Appendix E. Values for these factors were developed on a landscape basis, as defined below. Pesticide leaching potential is based on the soil persistence and herbicide mobility. For this planning effort, a highly leachable herbicide was modeled. This was done to give a "worst case" scenario.

The herbicide picloram (Tordon®) is considered a highly leachable chemical (Montana State University, Extension Service. 1990), (Kamrin, 1997, pages 8, 506-510). It is quite soluble in water, andit is poorly bound to soils. It is also moderately persistent (average of 90 days ½ life.) Degradation by microorganisms is mainly aerobic. Volatilization is low and photochemical degradation occurs only at the soil surface. For these reasons, picloram is used as an index in this evaluation. Because of its moderate ½ life, and high leachability it is not considered a candidate for long-term buildup in soils. However, traces of it can remain in the soil for up to eleven years, so it is important to carefully consider application rates (Rew, Lisa, PhD, Montana State University, personal communication 2003).

Factor definitions used in the RAVE score card system.

Irrigation Practice: A rating based on whether a field is flood, sprinkler or non-irrigated.
Depth to Ground Water: The distance, in vertical feet, below the soil surface to the water table.
Distance to Surface Water: The distance, in feet, from the application site to the nearest flowing or stationary surface water.
Percent Organic Matter: The relative amount of decayed plant residue in the soil (most Montana soils are < 3 percent).
Pesticide Application Frequency: The number of times the particular pesticide is applied during one growing season.
Pesticide Application Method: A rating based on whether the pesticide is applied above or below ground.
Pesticide Leachability: A relative ranking of the potential for a pesticide to move downward in soil and ultimately contaminate ground water based upon the persistence, adsorptive potential and solubility of the pesticide.
Topographic Position: Physical surroundings of the field to which the pesticide application is to be made. Flood plain = within a river or lake valley, Alluvial Bench = lands immediately above a river or lake valley, Foot Hills = rolling up-lands near mountains, Upland Plains = high plains not immediately affected by open water or mountains.

All spatial layers were co-located in a geo-database. Ratings for the factors listed above were assigned to soil survey map units. These were spatially joined to the buffered stream and lake layers to rate depth to ground water. All rankings were totaled and classed in ACCESS as described below for risk categories. The resulting layer was limited to the Gallatin National Forest boundary. This was joined to a sixth level Hydrologic Unit Code (HUC6) watershed layer and the layer showing existing weed infestations for the Forest. The resulting tables were queried to provide risk classification summaries by watershed and presence of weeds. All spatial data and analytical procedures are on file at the Gallatin National Forest.

The RAVE score card rates aquifer vulnerability on a scale of 30 to 100 for individual application sites and pesticides. Higher values indicate high vulnerability of ground water to contamination by the pesticide used in the evaluation. Those values greater than or equal to 65 indicate a potential for ground water contamination. In such instances alternative pesticides should be sought which have a lower leaching potential. Scores of 80 or greater indicate that pesticide

applications should not be made at this location unless an alternative product greatly reduces the score. Scores between 45 and 64 indicate a moderate to low potential for ground water contamination and scores less than 45 indicate a low potential for ground water contamination by the pesticide in question. Even in such cases, careful use of pesticides and following label instructions is imperative to protect ground water (Table 3-8 describes risk classes).

Table 3-8. Risk classes for herbicide/groundwater aquifer contamination.

RAVE Rating Score	Risk Class
< 45	Low
45-64	Low to moderate
65-79	High
80-100	Unacceptable

Affected Environment – Soils and Ground Water

Because of the relatively low proportion of weeds on the Gallatin Forest, there has not been a large soil effect from their incursion. Of 1.75 million acres, less than 12,600 acres have weed infestations. However, it is important to keep these values low to prevent soil degradation and erosion.

Other recent EIS documents (USFS, 2003. Helena National Forest DEIS and USFS, 2002. Beaverhead-Deerlodge National Forest EIS) have addressed the effects of weeds on soil organic matter, soil water interactions, soil evaporation rates, soil erosion, soil biota, and soil nutrients. The amount of impact is proportional to the amount of weeds. These documents also addressed the effects of herbicide on soil productivity. The Beaverhead-Deerlodge Noxious Weeds EIS stated that adverse effects of soil quality or productivity could not be detected (USFS 2002, page 3-43). They sited annual or semi-annual herbicide treated knapweed infested areas have lower knapweed cover and higher native grass cover than observed untreated knapweed stands. This agreed with studies elsewhere (Stalling, 1999). Since these documents did not find a measurable effect on projects that involved more acres (Helena National Forest proposed treatment on 23,000 acres, and the Beaverhead-Deerlodge National Forest proposed treatment on 16,000 acres) it is logical to assume that there will be no measurable effect with this proposed project. Consequently, the effects of weeds and herbicides on soil productivity will not be repeated in this document, rather they will be incorporated by reference (see soil analysis in project file).

Herbicide Degradation in the Environmental Fate

Pesticide applicators of today are faced with growing concern over the potential for pesticide contamination of ground water. Over 50 percent of all Montanan's and 95 percent of the agricultural community consume ground water as their source of drinking water. Protecting this fragile resource from pesticide contamination is imperative, because some pesticides may be harmful to humans at very low concentrations and clean-up of ground water is extremely difficult. Pesticide residues in ground water may also adversely affect sensitive crops and wildlife (Montana State University, Extension Service, 1990).

There are several ways for herbicides to damage resources. These include buildup in the soil, contamination of groundwater through infiltration, and surface runoff to streams. This analysis deals only with groundwater contamination and buildup. Other models are used to predict surface water contamination by runoff (see the following the water quality section).

Caution must be taken to avoid long-term buildup of herbicides in soils. Not only could they approach toxic levels, they may become more susceptible to movement and contamination as concentrations increase. Several processes affect persistence in soils (Vighi and Funari, 1995, pages 78-79). These include transport (volatilization, leaching, runoff, and erosion), adsorption and partition (immobilization by soil components), transformation (degradation by biological, photochemical, or other chemical processes), and plant processes (uptake, metabolization, immobilization.) Herbicides vary in their persistence, but generally have short "half-lives" (that period of time to degrade ½ of a given addition in or near the surface of the soil.) This measure is a result of those processes described above with the exception of removal.

WATER QUALITY, FISHERIES, and AMPHIBIANS

Regulatory Framework – Water Quality, Fisheries, and Amphibians

Clean Water Act and Montana Water Quality Act

Most of the Gallatin National Forest is classified at B-1 by the Montana Department of Environmental Quality (ARM 16.20.604). The associated beneficial uses of B-1 water are drinking, culinary and food processing purposes and conventional treatment: bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, furbearers, and other wildlife; and agricultural and industrial water supply (ARM 17.30.607 & 623). Wilderness areas are classified as A-1, as are municipal watersheds noted in the previous section.

Applicable standards for Montana's B-1 streams and rivers include maximum allowable increase in naturally occurring turbidity is five nephelometric turbidity units (NTU); and no increases are allowed above naturally occurring concentrations of sediment, settleable solids, oil, or floating solids, which will or are likely to create a nuisance or render the water harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish, or other wildlife (ARM 17.30.623).
In Montana, numeric water quality standards as specified in Circular Water Quality Bulletin WQB-7, Montana Numeric Water Quality Standards (MDEQ 2002) for human health water quality standards and herbicides that could be use in the Forest are listed in Table 3-9. No aquatic life standards have been established for these herbicides.

Table 3-9. Montana Water Quality Human Health Standards for Herbicides (micrograms/liter).

		Human health standard (micrograms/liter)	
Herbicide	**Category**	**Groundwater**	**Surfacewater**
cloryphralid	toxin	3,500	3,500
dicamba	toxin	210	210
2,4-D	toxin	70	70
imazapyr	carcinogen	21,000	21,000
methsulfuron methyl	toxin	1,750	1,750
chlorsulfunon	toxin	1,750	1,750
clopyralid	toxin	3,500	3,500

Herbicide	Category	Human health standard (micrograms/liter)	
		Groundwater	Surfacewater
sulfometuron methyl	toxin	1,750	1,750
picloram	toxin	500	500

Section 303(d) of the federal Clean Water Act directs states to list water quality impaired streams and develop "total maximum daily loads" (TMDLs) for the affected stream segment. The 2002 Montana DEQ 303(d) list includes 11 stream segments on the Gallatin National Forest including the Gallatin River, Squaw Creek, Taylor Fork, Cache Creek, East Boulder River, Mill Creek, Watkins Creek, Fisher Creek, and the Clarks Fork of the Yellowstone. Primary causes listed for stream impairment include flow alteration, siltation, land development, roads, and other habitat alterations. None of the Gallatin National Forest 303(d) listed sites had herbicides as a cause for impairment. A list, map, and impariment specifics as well as a description of the Montana DEQ 303(d) process is located at http://nris.state.mt.us/wis/environet/2002_303dhome.html.

Presidential Executive Order 12962

Presidential Executive Order 12962, signed June 7, 1995, furthered the purpose of the Fish and Wildlife Act of 1956, the National Environmental Policy Act of 1969, and the Fish and Wildlife Coordination Act, seeking to conserve, restore, and enhance aquatic systems to provide for increased recreational fishing opportunities nationwide. This order directs Federal agencies to "improve the quantity, function, sustainable productivity, and distribution of aquatic resources for increased recreational fishing opportunity by evaluating the effects of Federally funded, permitted, or authorized actions on aquatic systems and recreational fisheries and document those effects relative to the purpose of this order."

Land-use Strategy for Implementation of the 1999 Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout in Montana

The Memorandum of Understanding and Conservation Agreement (MOUCA) for Westslope Cutthroat Trout in Montana includes as objectives 1) protecting all pure and slightly introgressed (90 percent or greater purity) westslope cutthroat trout populations; and, 2) ensuring the long-term persistence of westslope cutthroat within their native range. The Land-use Strategy for Implementation of the 1999 Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout in Montana (Strategy) for the MOUCA, adopted by the Forest Service and Bureau of Land Management in 2002, further defines how the MOUCA will be implemented by federal land management agencies. For new activities, the Strategy stipulates that the Forest Service will 1) provide watersheds supporting conservation populations of westslope cutthroat trout with the level of protection necessary to ensure their long-term persistence; 2) defer any new federal land management action if it cannot be modified to prevent unacceptable aquatic/riparian habitat degradation; and 3) maintain westslope cutthroat trout habitat at 90 percent of optimum habitat conditions. When this 90 percent of optimum condition criteria is not met, only activities resulting in habitat improvement are to be considered. The Strategy also states that Forest Service Biological Evaluations (FSM 2670) prepared for new activities should, in most cases, conclude that there will be a beneficial effect or no effect to the westslope cutthroat trout population or its habitat. The Gallatin National Forest has adopted the Strategy for its Yellowstone cutthroat trout populations as well.

Sensitive Species

Sensitive species are those animal species identified by a Regional Forester for which population viability is a concern as evidenced by a significant current or predicted downward trend in population numbers, density, or in habitat capability that will reduce a species' existing distribution (FSM 2670.5.19). There are ten species listed as sensitive for the Northern Region.

Protection of sensitive species and their habitats is a response to the mandate of the National Forest Management Act (NFMA) to maintain viable populations of all native and desired non-native vertebrate species (36 CFR 219.19). The sensitive species program is intended to be pro-active by identifying potentially vulnerable species and taking positive action to prevent declines that will result in listing under the Endangered Species Act.

As part of the National Environmental Policy Act (NEPA) decision-making process, proposed Forest Service programs or activities are to be reviewed to determine how an action will affect any sensitive species (FSM 2670.32). The goal of the analysis should be to avoid or minimize impacts to sensitive species. If impacts cannot be avoided, the degree of potential adverse effects on the population or its habitat within the project area, and on the species as a whole needs to be assessed.

Forest Plan

Goals of the Gallatin National Forest Plan as they relate to fisheries include: 1) “Maintain and enhance fish habitat to provide for an increased fish population.” and, 2) "Meet or exceed State of Montana Water Quality standards”(USFS, 1987, page II-5). The Gallatin National Forest Plan Management Area (MA7) management goal is to “manage the riparian resource to protect the soil, water, vegetation, fish and wildlife dependent upon it”(USFS, 1987, page III-19). Gallatin National Forest Plan implementation guidelines further define how fish habitat will be maintained and enhanced through the development of a stream classification system, which corresponds to the sensitivity and importance of streams relative to their aquatic communities and environments. The intent of this classification system is to provide specific management objectives, along with a description of optimal habitat attributes that would be associated with the habitat objectives (Table 3-10).

Table 3-10. Optimal habitat attributes, from Gallatin National Forest Plan implementation guidelines, for streams within the analysis area (May 1996). “% fines” means the amount of fine sediments (<6.3 mm) deposited as a percentage of overall substrate composition

Stream Class	Class Description	Analysis area streams	Management objective	% fines	Annual/Cumulativ percent > natural
A	Streams with Sensitive *Spp* or Blue Ribbon Fisheries	All	90% (of pristine)	<25	30%/300%
B	Streams of regional or local importance as a fishery	None in the project area	75% (of pristine)	<30	50%/500%
C	Streams that support fish but have limited recreational value	None in the project area	60% (of pristine)	<35	60%/600%
D	Streams that do not support fish	None in the project area	Maintain water quality and channel integrity	NA	100%/1000%

The Gallatin National Forest Plan Management Area 7 management goal is to "manage the riparian resource to protect the soil, water, vegetation, fish and wildlife dependent upon it"(USFS, 1987, page III-19). Specific Management Area direction for livestock management requires that "livestock concentrations will be kept at a level compatible with riparian zone-dependent resource needs through development of pasture systems and associated improvements"(USFS, 1987, page III-20).

The Gallatin Forest Plan does not provide specific water resource direction for weed or herbicide treatments but references the "Watershed Management Guidelines for the Gallatin National Forest" (Glasser, 1987) which has several pesticide and chemical requirements including:

8.1 The Forest will use an interdisciplinary team approach in evaluating the practicality for pesticide/chemical application.

8.2 Apply Pesticide/Chemical according to label and EPA registration directions.

8.3 Provide feedback on effectiveness of pesticide placement near surface waters or other non-target areas.

8.4 Develop pesticide/chemical accidental spill contingency plans.

8.5 Leave a protection zone around stream, lakes, and wet areas or riparian areas to prevent pesticides falling directly into surface waters.

Affected Area – Water Quality, Fisheries, and Amphibians

Spatial Bounds: Aquatic environments in forested ecosystems are heavily influenced by the physical and biological processes within the watershed (Vannote et al. 1980). For this reason the analysis area, for both fish and amphibians, will encompass all watersheds within the project area boundary. These include all of the watersheds on the Gallatin National Forest (Table 3-11).

Table 3-11. Summary of Road density, Stream Buffers, Road Stream Intersections, and sensitive species known (bold type) or likely present (normal type) by HUC5. Species abbreviations are YCT, Yellowstone cutthroat; WCT, westslope cutthroat; NLF, northern leopard frog; WT, western toad. YCT and WCT designations indicate >90% genetic purity. Confirmed presence does not indicate uniform distribution in a drainage; for example, most cutthroat populations are fragmented and restricted to drainage headwaters.

HUC5 name	HUC number	acres	miles of road	miles of road per sq mile	acres of buffered stream	miles of road in stream buffer	Sensitive Species Present in Drainage
American Fork	10040201060	9816	3.57	0.23	1136	0.98	None known
Bangtail	10070003040	11566	99.03	5.48	1010	7.99	WT**, YCT**
Bear	10070001110	49348	161.43	2.09	4289	13.79	**YCT**
Bear-Wilson	10020008070	35078	268.85	4.91	2800	20.06	**WT, WCT, NLF**
Beaver-Cabin	10020007060	58040	27.26	0.30	5326	2.96	**WCT,** WT
Big Timber	10070002070	33872	47.99	0.91	3876	9.12	**YCT**
Big-Rock	10070002020	101210	231.65	1.46	8924	31.11	**YCT**

HUC5 name	HUC number	acres	miles of road	miles of road per sq mile	acres of buffered stream	miles of road in stream buffer	Sensitive Species Present in Drainage
Boulder	10070002080	189255	89.96	0.30	14825	19.89	**YCT, WT**
Bozeman-Bear	10020008080	34925	131.58	2.41	2571	14.04	**WT, NLF**
Brackett	10070003030	20313	140.26	4.42	2500	25.78	**YCT, WT**
Bridger	10070002130	12547	27.30	1.39	1239	10.74	WT
Broadwater-Lake	10070006080	74945	32.79	0.28	5098	2.57	WT
Buck	10020008040	35755	208.41	3.73	3164	20.85	**WCT,** WT
Buffalo	10070001090	93642	0.00	0.00	6746	0.00	WT
Cascade	10020008060	37810	20.33	0.34	4137	5.67	WT
Cherry	10020007160	17591	11.23	0.41	1457	0.37	**WCT***, **WT**
Cottonwood	10020008110	15403	3.28	0.14	1728	0.94	**YCT,** WT
Deer	10070002110	47334	49.42	0.67	4302	10.35	**YCT**
Flathead	10070003010	26136	140.29	3.44	2106	16.29	**YCT**
Hebgen Lake	10020007050	100031	426.25	2.73	9057	22.68	**WCT, WT**
Hellroaring	10070001100	86337	0.00	0.00	5183	0.00	WT
Hyalite	10020008090	32671	158.65	3.11	3527	21.36	**WCT, WT**
Jackson	10020008080	20423	169.82	5.32	2122	18.45	WT
Mill	10070002030	97062	110.91	0.73	7911	19.86	**YCT**, WT
Mission	10070002050	15098	10.53	0.45	1210	2.74	**YCT**
Pass-Reese	10020008100	21122	30.05	0.91	1957	3.90	WT
Porcupine	10020008040	60675	18.21	0.19	6321	8.23	WT
Rock	10070003040	32510	42.21	0.83	3326	5.73	**YCT**
Sage-Tepee	10020008010	55360	18.42	0.21	4651	4.88	WT
Sheep-Mile	10020007080	15710	15.83	0.64	1337	1.95	None Known
Shields	10070003020	55106	330.58	3.84	6028	50.27	**YCT, WT**
Sixmile	10070002020	40886	40.84	0.64	2938	8.99	**YCT**
Sixteenmile	10030101030	27156	117.50	2.77	2629	18.63	WCT
Slushman	10020008080	9123	57.74	4.05	1133	9.18	WT
Soda Butte	10070001090	10140	56.73	3.58	564	3.29	**YCT, WT**

*Introduction planned in 2005 or 2006

Temporal Bounds: Because stream fish habitats may continue to be impacted by anthropogenic activities for many decades after the initial disturbance, temporal cumulative effects for fish and fish habitat will span the breadth of known human activity in the project area. Therefore, the temporal bounds for fish and fish habitat is from 1880 to five years after project implementation (year 2009).

Amphibian habitats may also be negatively impacted long after certain types of anthropogenic actions (Maxell, 2000). Therefore, the cumulative effects will be examined for the period for which literature suggests habitat may continue to be impacted: 50 years in the past (1953) and 5 years into the future (2009).

Activities considered in the cumulative effects analysis include those directly modifying fish and amphibian habitat as well as those indirectly modifying sediment delivery and routing, and modifying hydrologic regimes. These activities include past road construction and stabilization, vegetation management, grazing, recreation, trail maintenance, and past wildfires (Table 3-12).

Table 3-12. Common Gallatin National Forest land management activities and associated levels of impacts.

ACTIVITY	TYPICAL HABITAT ALTERATION OR IMPACT ON AQUATIC SPECIES	CURRENT DEGREE OF IMPACT
Livestock grazing	Bank alteration, stream channel over-widening, sediment introduction	Low to high
Timber harvesting	Sediment introduction, reduction of woody debris recruitment potential, modified water temperature regimes	Low to high
Road building	Sediment introduction, migration barriers	Moderate to high
Recreation (non-fishing)	Sediment introduction, habitat modification	Low
Recreational fishing	Hooking and handling mortality; harvest	Low to high
Water withdrawal	Reduction of instream flows	Low to moderate
Dams	Altered water temperatures, fish migration barriers, altered sediment transportation, altered aquatic communities, altered flow regimes	Moderate to high
Lake fish stocking	Competition/hybridization between introduced species and native species	High
Noxious weed management	Chemical poisoning of aquatic organisms	Low

Affected Method – Water Quality, Fisheries, and Amphibians

The methodology of analysis used for this EIS is based on the Beaverhead-Deerlodge National Forest Noxious Weed Control Program Final EIS (2002) Section 4.4.1. Water and fish resources were evaluated together because of related impacts from herbicide application for the control of noxious weeds on the Gallatin National Forest. Active ingredients in herbicides proposed for use, and analyzed, include 2,4-D, chlorsulfunon, clopyralid, dicamba, glyphosphate, hexazinone, imazapyr, metsulfuron methyl, picloram, imazapic, sulfometuron methyl, and triclpyr. Impacts on aquatic organisms, including fish, amphibians, and their habitat, including Management Indicator Species and sensitive species, were analyzed by considering:

- Research results and other literature on individual herbicide characteristics and toxicities for different aquatic species;
- Studies evaluating potential for herbicide entry into surface and groundwater, via different routes (leaching, overland flow, direct application, and drift);
- Results of recent analyses conducted by other National Forests in Region 1;
- Specific mitigations comprising part of each alternative for this EIS;
- Scope of the proposed treatments;
- Treatment methods proposed within alternatives;
- Proximity of proposed treatments to water bodies supporting westslope and Yellowstone cutthroat trout and other sensitive species.

The Beaverhead-Deerlodge National Forest Noxious Weed Control Program Final EIS (2002) Section 4.4.1, pages 4-13 through 4-16 evaluated herbicide characteristics and toxicities and concluded that picloram tends to be more toxic to aquatic organisms than any of the other herbicides. With this in mind, picloram is used as a surrogate for all herbicides to assess risks to aquatic species in this analysis. For this analysis, selection of a "safe" concentration level for fish

follows recommendations presented in the Fisheries and Herbicides Work Group Findings and Recommendations, Draft Version 3c (March 19, 2003). The "safe" concentration level chosen is synonymous with a "maximum allowable toxicant concentration" or MATC equaling 0.075ppm. This value was derived by taking 1/20 of 1.5 ppm (the 96 hour LC-50 for cutthroat trout).

Method of risk assessment for the amount of picloram which could be applied in Alternative 1 are the same as in the Beaverhead-Deerlodge National Forest Noxious Weed Control Program Final EIS (2002) Section 4.4.1, pages 4-17 steps 1-5. Rather than use storm events the Gallatin National Forest analysis was based on flow duration curves developed from daily discharge data of US Geologic Service gauging records of six gauges on or near the Gallatin National Forest. The drainage areas varied from 48-98 mile^2 and a period of record from 11 to 100 years. A Q95 (95 percent of the time flows are greater than) regression for the six gauges was used to determine the Q95 low flow for each HUC 6 (sixth order hydrologic unit code). The equation is Q95 discharge = $0.2143x^{0.893}$ ($R2 = 0.7149$) where x is the watershed size in square miles. Minimum capacity for dilution (C), maximum probable concentration, and maximum pounds of herbicide per application were then calculated for each HUC6.

Affected Environment – Water Quality, Fisheries, and Amphibians

Water quality in the Gallatin National Forest is unique in that headwaters of most of the streams occur in Gallatin National Forest wilderness areas, other unroaded areas, or in Yellowstone National Park. Water quality is generally excellent but is influenced by multiple use activities on Gallatin National Forest and private lands. The Gallatin National Forest contains about 1,000 miles of fishable perennial streams, several of which are of national scenic, historic, and recreational significance. The headwaters of the Madison, Gallatin, Yellowstone, and Boulder Rivers occur on or just upstream of the Forest in Yellowstone National Park. These "blue ribbon" rivers and tributaries have generally excellent water quality and provide an important source of aesthetics, recreation, wetland and riparian habitat, and water supply for a variety of downstream beneficial uses (domestic, irrigation, municipal, and agricultural). The Gallatin National Forest provides approximately two million acre-feet of water per year to the Missouri River system.

Average precipitation on the Forest varies from 15 to 65 inches a year with about 50 percent as snow in lower elevations and 75 percent at higher elevations. June receives the largest amount of moisture. Average snowfall varies from about 60 inches in the Deer Creek area and Paradise Valley to about 400 inches in the Beartooth Range. Precipitation intensity is relatively moderate. The two year-six hour precipitation varies from 0.7 to 1.5 inches (Miller et al. 1973). Winters are long and cold and snow usually remains at the higher elevations for eight to nine months. Snowdrifts can persist in some high elevation cirques and passes throughout the year. Summertime temperatures remain in the 70's and 80's with occasional 90 degree temperatures.

For most of the Gallatin National Forest, private agriculture (primarily ranching) or rural home sites are adjacent to the Forest with more extensive irrigation agriculture land use further downstream. With the exception of the West Yellowstone and Gardiner, which directly abut the Gallatin National Forest, concentrated urban areas are about ten miles from the Gallatin National Forest including Bozeman, Livingston, and Big Timber. Downstream beneficial uses of the Gallatin National Forest include fish and aquatic life, recreation, irrigation, stock use, public water supply, private water supply, and wildlife. Hyalite Creek and Bozeman Creek are designated as municipal watersheds for the city of Bozeman and have substantial water diversions and a water treatment facility near the Gallatin National Forest boundary. Several ditch associations have diversions on the Gallatin National Forest and distribute water over large areas with ditch systems. The Madison, Gallatin, Yellowstone, and Boulder Rivers provide increasing

amounts of recreation for floating including drift boats, rafts, canoes, and kayaks. The watersheds (HUC5s) with the greatest number of miles in the stream buffer and number of road stream intersections are also those with the greatest number of road miles (Table 3-11). These include Bear-Wilson, Big-Bear, Brackett, Buck, Hegben Lake, Hyalite, Jackson, Mill, Shields, South Plateau, Squaw, Taylor Fork, Trail, and West Fork Gallatin.

A major beneficial use in, and downstream of, the Gallatin National Forest is salmonid habitat. The Gallatin National Forest encompasses many of the headwater tributaries of the Madison, Gallatin, and Yellowstone Rivers, which are Blue Ribbon trout fisheries. Several significant tributaries such as Squaw Creek, Swan Creek, Hyalite Creek, Mill Creek, South Rock Creek, Bear Creek, Shields River, and Big Timber Creek provide fish habitat that supports the nationally renowned trout fisheries.

Sensitive fish and amphibian species historically present in the project area were westslope cutthroat trout (*Oncorhynchus clarki lewisi*), Yellowstone cutthroat trout (*O. clarki bouvieri*), Arctic grayling (*Thymallus arcticus*), northern leopard frog (*Rana pipiens*), and boreal toad (*Bufo boreas*). Currently, Arctic grayling are not known to exist on the Gallatin National Forest and their status off the Forest is also uncertain. The distribution of Yellowstone and westslope cutthroat in Gallatin National Forest watersheds is restricted from its historic range, with westslope cutthroat currently occupying 33 miles of stream and Yellowstone cutthroat about 700 miles. Amphibian distribution is likely also truncated, although distribution data are limited (Atkinson and Peterson 2000, Maxell 2000). The current distribution of both sensitive fish and amphibian species, by watershed, is displayed in Table 3-11 above. All wild trout are Management Indicator Species (MIS) for project area streams; MIS occurring in the project area include brook (*Salvelinus fontinalis*), rainbow (*O. mykiss*), Yellowstone cutthroat, westslope cutthroat and brown trout (*Salmo trutta*).

Wetlands are lands in transition between terrestrial and aquatic systems where the water table is at or near the surface of the land and often covered by shallow water. In order to be considered jurisdictional wetlands, the wetland must be saturated and at least part of a year have un-drained hydric soils, and support predominantly hydrophytic vegetation. Wetlands are extremely valuable to recreational users, esthetic quality, and wildlife habitats, and serve important functions such as sediment filtration, flow moderation, nutrient and other pollutant attenuation. They also act as sources of organic energy for adjacent aquatic habitats. The Gallatin National Forest is heavily dissected and well drained, and has limited areas of wetlands. The most frequent type of wetlands on the Forest include lacustrine wetlands along lake and pond shorelines, palustrine wetlands of wet meadows and forested wet areas, and riverine wetlands along perennial stream channels and springs.

In general, the Gallatin National Forest has limited wetlands in upper and mid slope positions where some slump related palustrine wetlands, and narrow riverine wetlands occur. The majority of Forest wetlands are located on low slope positions, mostly in the stream and buffer areas listed in Table 3-11.

The Gallatin National Forest has two large reservoirs (Hegben Lake and Hyalite Reservoir), several small reservoir/stock ponds, and multiple water diversions. Canals and pipeline distribution systems are fairly limited as most of the steam diversions occur below the Forest boundary. Large water diversion systems and associated pipeline or ditches on the Forest include the Mill Creek NRCS 566 ditch, Pine Creek diversions, Cottonwood Creek flume and diversions,

Sheep and Mile Creek diversions, and Hyalite and Bozeman Creek diversion structures and pipelines for the City of Bozeman water system.

The Gallatin National Forest has two roaded municipal watersheds, Hyalite Creek and Bozeman Creek, which are the main source of municipal water for the City of Bozeman. The City Water Treatment Plant is located below the Forest boundary, near Bozeman Creek with treatment supply consisting of about 2/3 Bozeman Creek water and 1/3 Hyalite Creek water. The Montana DEQ has designated Bozeman Creek as an A-Closed watershed and Hyalite Creek as A-1 (Montana Water Quality Standards, ARM 17.30.610) which are very restrictive designations to protect water quality. As for Bozeman Creek, the A-Closed designation does not allow for motorized public use and no livestock grazing is permitted. Hyalite Creek is very heavily used for developed and dispersed recreation with constrained motorized recreation activities.

WILDLIFE

Regulatory Framework – Wildlife

Regulations on wildlife resources are outlined in 36 CFR 219.12 and 219.27. These regulations state that management indicator species (MIS) will be identified by each national forest in order to adequately maintain distributed habitat for these species and to evaluate the impacts of management activities on these species. Forest Service Manual 2670.31 (6) directs "identify and prescribe measures to prevent adverse modification or destruction of critical habitat and other habitats essential for the conservation of endangered, threatened, and proposed species."

Forest Service Manual 2670 at 2670.22 – Sensitive Species, provides the following direction for sensitive wildlife:

- Develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions;
- Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on national forest system lands;
- Develop and implement management objectives for populations and/or habitat of sensitive species.

The Endangered Species Act requires the conservation of threatened and endangered species, and prohibits carrying out or authorizing any action that may jeopardize a listed species or its critical habitat.

The National Forest Management Act provides for balanced consideration of all resources. It requires the Forest Service to plan for diversity of plant and animal communities. Under its regulations, the Forest Service is to maintain viable populations of existing and desired species, and to maintain and improve habitat of management indicator species.

The Gallatin National Forest Plan provides standards and guidelines for management of wildlife species and habitats on the Forest. The Forest Plan also identifies Management Indicator Species.

Affected Area - Wildlife

The analysis area for wildlife includes species-specific habitats in proximity to proposed treatment areas. These habitats have the potential to be directly or indirectly impacted by herbicide application and disturbances associated with the proposed weed treatment methods.

Analysis Method - Wildlife

Published reports in scientific journals were reviewed along with file data from the Gallatin National Forest, unpublished reports, and personal communications. A detailed discussion of the effects on wildlife of each herbicide proposed is included in the project file.

Information on ecology, distribution, and habitat affinities for sensitive species was also obtained form Montana Natural Heritage Database on the internet at http://nris.state.mt.us/animal/index.html.

Species known to occur on the Forest and species with the potential to occur are identified and discussed. Potential impacts were assessed based on animal habitat affinities and probability that a given habitat would be treated with herbicide to control noxious weed communities.

Affected Environment - Wildlife

The wildlife issue is ground into four main categories: Threatened and Endangered Species; Sensitive Species; Management Indictor Species; Migratory Birds and Biodiversity; and Herbicide Toxicity to Terrestrial Mammals and Birds.

Threatened And Endangered Species

Grizzly Bear

The grizzly bear was once found throughout much of the lower 48 states west of the Mississippi River. Currently, their distribution is restricted to five discreet populations: the Greater Yellowstone Ecosystem in portions of Montana, Wyoming, and Idaho; the Northern Continental Divide Ecosystem in Montana; the Cabinet-Yaak area in Montana and Idaho; the Selkirk Mountains in Idaho and Washington; and the North Cascades in Washington (Servheen, 1993, pages 11-13). The Gallatin National Forest provides important habitat for grizzly bears in the Yellowstone Ecosystem. The Greater Yellowstone Ecosystem grizzly bear population has increased in size and distribution over the past decade, and has now met all recovery criteria (IGBC, 2003, page 16). They have expanded their range on the Forest over the past several decades, and most areas of the Forest located south of interstate highway I-90 are currently occupied habitat (Schwartz *et al.,* 2002, page 209).

Grizzly bears are large omnivores that typically utilize a wide variety of foods. Vegetation such as roots, tubers, bulbs, berries, nuts, and green herbaceous plants are seasonally important to grizzly bears. Additionally, high calorie animal food sources such as ungulates, ground squirrels, carrion, fish, and insects are highly valuable to them when they can be obtained (Servheen, 1993, page 7). To utilize such a wide variety of foods, bears use a wide variety of vegetation types spread out over large distances. These vegetation types include lower elevation sagebrush/grasslands or Douglas-fir stands as well as higher-elevation whitebark pine, lodgepole pine, and Engelmann spruce/subalpine fir.

Because maintaining secure areas with low levels of human disturbance is a key component of grizzly bear habitat management, Amendment 19 to the Gallatin Forest Plan adopted guidance from the Interagency Grizzly Bear Committee Taskforce Report – Grizzly Bear/Motorized Access Management (IGBC, 1998) as standards for road density and motorized access within the recovery zone. These standards require that there be no decrease in core areas within each Bear Management Subunit. Core areas are at least 0.3 miles from any open road or trail, where no motorized or high-intensity non-motorized use is allowed during the non-denning period. The Final Conservation Strategy for the Grizzly Bear in the Yellowstone Area provides additional direction for access management, and specifies that reoccurring low-level helicopter flights should not be allowed within 500 meters of core habitat (IGBC, 2003, page 41).

The use of sheep or goat grazing as a weed management tool has the potential to cause conflicts with grizzly bears. Grizzly bear depredations on domestic sheep and goat grazing allotments have long been a source of conflict between humans and bears. The Gallatin Forest Plan (USFS, 1986, pages G-15, G-16) and Final Conservation Strategy for the Grizzly Bear in the Yellowstone Area (IGBC, 2003, page 43) both contain standards addressing this fact. The applicable Forest Plan standards are: 1) the District Ranger will specify in the annual permittee plan of use appropriate measures for removal or destruction of livestock carcasses to avoid habituation of grizzlies to livestock as food; 2) in the event livestock are preyed upon, the following procedures will be used...remove livestock from allotment. The standards from the Conservation Strategy are: 1) no new active commercial livestock grazing allotments will be created inside the primary recovery area; and 2) there will be no increases in permitted sheep animal months inside the primary recovery area from the identified 1998 baseline.

Gray Wolf

Wolves were reintroduced to the Yellowstone area in 1995. The Forest Service is a full partner in implementing the conservation measures outlined in the Federal Register final rule, November 22, 1994. Wolves reintroduced to Yellowstone National Park (YNP) and the Greater Yellowstone Area (GYA), have been designated as a non-essential experimental population in accordance with Section 10 of the Endangered Species Act. The gray wolf historically occupied the Gallatin National Forest, and the Forest is within the Greater Yellowstone Gray Wolf Recovery Area. As of January 2002, there were an estimated 271 wolves in this area (USFWS *et al.*, 2003, page 1). There are approximately 14 packs whose territories are entirely or partially within the Forest, but only 1-2 packs are known to den on the Forest (J. Fontaine, U.S. Fish & Wildlife Service, personnel communication on 04/28/03).

In the Yellowstone area, wolves feed on elk, deer, moose, bison, and other ungulates, but elk are their primary prey (USFWS *et al.*, 2003, page 12-13). Wolves have also preyed on livestock (USFWS *et al.*, 2003, page 17). Wolves follow big game movements and may concentrate on elk winter ranges or elk calving areas (USDI 1993, pages 6-27 to 6-28). Pups are whelped in a den during the spring (Mech, 1970, page 123), and moved to a rendezvous site several months later when they are able to leave the den until they are mobile enough to travel with the pack (Mech, 1970, page 146-148).

Wolf territories are variable and may range from 60 to 900 square miles in size. Wolf packs recently reintroduced into YNP initially ranged over an area of 650 square miles (Fritts *et al.* 1997, pages 22-23). Wolves may occupy a variety of habitats including grasslands, sagebrush steppes, coniferous and mixed forests, and alpine areas. Wolf distribution and habitat use is more closely tied to availability of food (especially ungulate prey) and denning areas than to vegetation

cover type. Because of this, there would be overlap between wolf habitat and areas infested with weeds.

Canada Lynx

Optimal lynx habitat can generally be described as a mosaic of early-successional forest stands for foraging and late-successional forests with deadfall for security cover and denning habitat (Ruggiero *et al.*, 1994, page 86). Lynx inhabit the mid to high elevations where snow excludes most other predators during winter. Denning habitat occurs most often in subalpine fir forests where there is a high amount of down material (Ruggiero *et al.*, 1994, page 89). Snowshoe hares are the primary prey for lynx. Primary forest types that support snowshoe hare are subalpine fir, Engelmann spruce, Douglas-fir and lodgepole pine. The key component of snowshoe hare habitat is dense understory vegetation. In winter, lynx forage for hares in vegetation that provides a high density of young conifer stems or branches that protrude above the snow (Ruediger *et al.*, 2000, page 1-4 and 1-7). Snowshoe hares appear to avoid clear-cuts and very young stands (Ruediger *et al.*, 2000, page 1-7).

Lynx habitat and weed infestations generally do not overlap, because lynx are typically found in dense forested stands in which weeds are not able to compete with native vegetation. Although approximately 9 percent (or 1,000 acres) of known weeds infestations on the Forest are in subalpine fir habitat types, these are generally found in clearcuts that have not yet regenerated enough for weeds to be shaded out, and are unsuitable lynx habitat. The exception is orange hawkweed, which can invade closed-canopy forests and is currently known to occur on one 20-acre site on the Forest. Because its distribution is so limited, treatments of orange hawkweed are not expected to occur within the next 10-15 years on a scale that could affect lynx or their habitat. Therefore, lynx will not be discussed further in this report.

Bald Eagle

The Forest provides yearlong habitat for bald eagles. In Montana, bald eagle nest sites are generally distributed around the periphery of lakes and reservoirs greater than 80 acres (32.4 ha) as well as in forested corridors within one mile (1.6 km) of major rivers (MT Bald Eagle Working Group, 1994, page 2). There are currently six known active nest sites on the Forest, all of which are in the Hebgen and Earthquake Lake area near West Yellowstone. Three of these nests are located in a relatively small area on Horse Butte along Hebgen Lake. In Montana, an annual breeding cycle from initiation of courtship and nest building through fledging of young occurs approximately from February 1-August 15 (MT Bald Eagle Working Group, 1994, page 22). Once fledged, young are dependent on adults for six to ten weeks (MT Bald Eagle Working Group, 1994, page 3).

Adults may migrate or remain within their ecosystems during the winter. Wintering bald eagles occupy areas near unfrozen portions of lakes and free flowing rivers, or upland areas where ungulate carrion and lagomorphs are available (MT Bald Eagle Working Group, 1994, page 4). Bald eagles primarily winter in open water areas of Hebgen and Earthquake Lakes, and along the Madison, Gallatin, and Yellowstone Rivers.

An available prey base may be the most important factor determining the nesting habitat suitability, the nesting density and the productivity (MT Bald Eagle Working Group, 1994, page 2) of bald eagles. Bald eagles are opportunist feeders and will prey on fishes, waterfowl, lagomorphs, and some ground dwelling mammals, as well as ungulate carrion. In the Hebgen Lake area, fish made up the majority of prey items observed obtained by breeding pairs (Stangl,

1994, page 73). Ungulate carrion and waterfowl may also have been seasonal food sources (Stangl, 1994, page 74).

Bald eagles may be affected by a variety of human activities (MT Bald Eagle Working Group, 1994, page 4). Responses of eagles may range from abandonment of nest sites to temporary temporal and spatial avoidance of human activities. Responses may also vary depending on type, intensity, duration, timing, predictability and location of human activities. Individual pairs may respond differently to human disturbances because some birds are more tolerant than others (MT Bald Eagle Working Group, 1994, page 4). Generally, eagles are most sensitive to human activities during nest building, egg-laying, and incubation from February 1-May 30 (MT Bald Eagle Working Group, 1994, page 22). Human activities during this time may cause nest abandonment and reproductive failure. Once young have hatched, a breeding pair is less likely to abandon the nest. However, eagles may leave the nest due to prolonged disturbances, exposing young to predation and adverse weather conditions (MT Bald Eagle Working Group, 1994, page 22). Weed treatment activities have the potential to cause disturbance to nesting bald eagles if they occurred within nesting territories.

The Gallatin Forest Plan (USFS, page II-19) specifies that management direction for bald eagles would be provided by the Greater Yellowstone Bald Eagle Management Plan (Greater Yellowstone Bald Eagle Working Group 1996). This document provides guidelines for managing human activities around bald eagle nest sites (Greater Yellowstone Bald Eagle Working Group, 1996, pages 24-25). It recommends that human activities should not exceed minimal levels (no human activity except for existing agricultural uses, nesting surveys, or river boat traffic during less than 70 percent of daylight hours) within the occupied nesting area or zone I (less than 400 meter from a nest) of eagle nests from February 1-August 15. Within the primary use area or zone II (less than 800 meter from a nest), no more than light human activity levels (day use and low impact activities at low densities and frequencies) should be allowed during the same time period. Moderate activity (low impact activities at any intensities) would be allowed within the home range or zone III (<4 km of a nest).

Sensitive Wildlife Species

Sensitive species are those animal species identified by the Regional Forester for which population viability is a concern as evidenced by a significant downward trend in population numbers, density, or in habitat capability that will reduce a species' existing distribution (FSM 2670.5.19). There are eight terrestrial wildlife species listed as sensitive for the Northern Region National Forests including the Gallatin, and which are discussed in this section. Sensitive fish and amphibians are addressed in the Fisheries/Amphibians section. Sensitive plants are addressed in the Vegetation section.

Protection of sensitive species and their habitats is a response to the mandate of the National Forest Management Act (NFMA) to maintain viable populations of all native and desired non-native vertebrate species (36 CFR 219.19). The sensitive species program is intended to be proactive by identifying potentially vulnerable species and taking positive action to prevent declines that will result in listing under the Endangered Species Act.

As part of the National Environmental Policy Act (NEPA) decision-making process, proposed Forest Service programs or activities are to be reviewed to determine how an action will affect sensitive species (FSM 2670.32). The goal of the analysis should be to avoid or minimize impacts to sensitive species. If impacts cannot be avoided, the degree of potential adverse effects

on the population or its habitat within the project area and on the species as a whole needs to be assessed.

Peregrine falcons

Peregrines occupy a variety of habitat but are typically found near water because of the abundance of prey associated with such sites. Nests are generally located below 8500 feet in elevation, less than 3,000 feet from water or a wetland, on a greater than 150 percent slope, and on a cliff ledge that is 3,000 feet in length and greater than 4,000 feet in height. Prey consists almost entirely of birds, which are usually taken on the wing. Surveys of potential peregrine falcon nesting habitat are completed on the Forest each year to monitor known nest sites and document new breeding pairs. There are 11 known active or historic eyries on the Forest with five located on the Bozeman District, three on the Hebgen Lake District, two on the Big Timber District, and one on the Livingston District.

It appears that peregrine falcons are sensitive to human activities, especially those occurring above the nest site. They are more tolerant of activities that occur below the nest site if there is pronounced relief from the valley floor to the nest site (U.S. Fish and Wildlife Service, 1984, pages 9-10). Human disturbance at the nest may lead to abandonment and interference with care of the chicks. Guidelines for minimizing disturbance to nesting peregrine falcons are to restrict human activities and disturbances in excess of what historically occurred during the nesting season within one mile of nest cliffs (U.S. Fish and Wildlife Service, 1984, page 34). The use of pesticides that persist in the environment and magnify through the food chain also presents a risk to peregrines (U.S. Fish and Wildlife Service, 1984, pages 9-10). Because peregrines may forage in a variety of habitats, some areas used by these birds for foraging may be at risk of weed infestation while others would not be. Peregrine eyries may be located near weed infestations.

Northern goshawk

The goshawk is a large forest-dwelling hawk. Their prey may include grouse, smaller birds such as jays and woodpeckers, snowshoe hares, and squirrels (Reynolds *et al.*, 1992, page 4). Reynolds et al. (1992, page 3) identified the three components of a goshawk nesting home range as being the nest area, post-fledging family area (PFA), and foraging area. Nest areas are composed of older-aged forests with a closed canopy and larger diameter trees located on northern aspects with gentle to moderately steep slopes below 7500 feet in elevation (Reynolds *et al.*, 1992, page 22). PFA's contain a large percentage of mature forest habitat. Closed crowns forming a matrix enable young fledged birds to branch from one tree to the next and move throughout the forest canopy. Foraging areas are increasingly larger and more diverse than either the habitat maintained for nesting or the PFA. A diverse complex of vegetation within the foraging area supports a varied and abundant preybase. Foraging habitat in Montana includes forest edges, open meadows, and moderate to densely forested stands (Hayward *et al.*, 1990, page 21). Goshawks are known to occur on the Forest and suitable goshawk habitat is found on all districts, but the number of nesting goshawks is unknown. Goshawk foraging areas may include areas at risk of weed infestations, but nesting and PFA's would generally not because canopy closure would be too great. A possible exception is orange hawkweed sites, which currently are known to occur on only one 20-acre site on the Forest.

Flammulated owl

The flammulated owl is a small, secretive owl that is known to occur over a wide geographic area in interior mid-elevation montane forests from British Columbia to south of the Mexican border

(Hayward and Verner, 1994, page 17). It is an obligate secondary cavity nester that breeds in open ponderosa pine, Douglas fir, or mixed species forests. They are nocturnal hunters that feed mostly on arthropod prey (Hayward and Verner, 1994, page 27). The flammulated owl tends to avoid both arid and cold areas, and upper-elevation forests. Due to its secretive nature and a lack of targeted survey efforts, population trends for flammulated owls are uncertain although they now appear to be more common than was once thought (Hayward and Verner, 1994, page 18). On the Gallatin National Forest, flammulated owls are known to occur only on the Big Timber Ranger District within ponderosa pine/Douglas fir forest, although there has been little effort to survey specifically for this species. Habitat is limited on the Forest because ponderosa pine stands are rare and many Douglas fir stands have lost their historically open-canopy structure as a result of fire suppression. Other forest types found on the Gallatin such as lodgepole pine, Engelmann spruce/subalpine fir, and whitebark pine, are unsuitable habitat for flammulated owls. Flammulated owl foraging habitat would likely include areas at risk of weed infestation.

Wolverines

Wolverines are the largest member of the weasel family. Although few studies have been conducted on them, they appear to utilize a wide variety of food sources including carrion, rodents, berries, insects, and birds (Reel *et al.*, 1989, page 32; Ruggiero et al. 1994, page 111-113). In the western United States they occupy a variety of mostly remote montane habitats throughout the year including alpine areas, boulder and talus fields, mature and intermediate forests adjacent to natural openings, big game winter ranges, and riparian areas (Reel *et al.*, 1989, page 32; Ruggiero et al. 1994, pages 100-115). Extensive travel by wolverines is not unusual and home ranges are typically very large (Ruggiero *et al.*, 1994, page 117). Although wolverine populations have increased in western Montana since the 1920's, they occur at low densities even where habitat is optimal (Ruggiero *et al.*, 1994, page 103). Suitable habitat for wolverines on the Forest is found in the Beartooth, Absaroka, Bridger, Crazy, Gallatin, Madison, and Henry's Lake Mountain Ranges. Wolverines are known to occur on the Forest as they are legally trapped on occasion and observations of wolverines or their tracks are regularly reported, but their distribution and abundance remains unclear. Most wolverine habitat would be at low risk of weed infestation, with the exception of big-game winter ranges.

Western (Townsend's) big-eared bat

The distribution of the western (Townsend's) big-eared bat is strongly correlated with the availability of caves or abandoned mine shafts where they winter in communal roosts and where females roost with their young. If suitable roosting areas are available, they occur within a wide variety of habitats from arid pine forests to high-elevation mixed coniferous forests (Reel *et al.*, 1989, page 38). Foraging habitat includes riparian areas, forest edge, and diverse forest stands. They are insectivorous and feed primarily on moths. The disruption of roosting habitat can cause permanent abandonment of roost sites (Reel *et al.*, 1989, page 39). Although there is suitable habitat for this species on the Forest, there are no known hibernacula or roost sites and their distribution and abundance is poorly understood. Western big-eared bat foraging habitat could include areas at risk of weed infestation.

Black-backed woodpecker

Black-backed woodpecker inhabits mature to over-mature coniferous forests across North America. It is rare throughout its range, but may be locally common in response to a temporary abundance of food. Black-backed woodpeckers respond opportunistically to insect outbreaks and seem to prefer recently burned stands, where it forages on insects. Populations of the black-

backed woodpecker tend to be irruptive in nature and correspond with the sporadic abundance of bark beetles, its preferred prey. The woodpecker shows a preference for mature pine stands at elevations at or below 6,000 feet (Cherry, 1997). Black-backed woodpeckers will use higher elevation areas once a fire or other disturbance occurs which brings in snags and insects (Cherry, 1997). Burned areas inhabited by this species may be at high risk for weed infestation. However, they are dependant on forest structure rather than ground vegetation, and would not be affected by project activities. Therefore, they will not be discussed further in this document.

Trumpeter swan

The trumpeter swan is the largest of North American waterfowl. Their populations have increased dramatically since the early 1900's, when over-exploitation had reduced their numbers to a few birds in Yellowstone National Park and the adjacent Red Rock Lakes area. They nest in wetland habitat including secluded shallow marshes, lakes, and rivers, and often return to the same nest sites each year (Reel *et al.*, 1989, page 26). Large numbers of trumpeters winter in the Greater Yellowstone area where open water and aquatic vegetation are available. On the Gallatin National Forest, Hebgen Lake provides spring and winter habitat for the trumpeter swan. Historic nest sites were located in the Taylor Fork drainage and along the Gallatin River, but swans have not been observed to nest in either area in recent years. Due to spatial separation of preferred habitats and areas at risk of weed infestation, trumpeter swans would not be affected by this project and will not be discussed further in this document.

Western harlequin duck

Western harlequin duck population winters along the north Pacific Coast, and migrates inland to breed east to the Rocky Mountains. They occupy fast, swift moving mountain streams during the breeding season. Females usually return to the same breeding sites each year (Reel *et al.*, 1989, page 34). Despite survey efforts on the Forest, the harlequin duck is known to nest only on the Big Timber District. Harlequin drakes have been observed on the Madison River on the Hebgen Lake District in early spring (Marion Cherry, Forest Biologist, Gallatin N.F.), and it is suspected that this area is used as a temporary stopover point during spring migration. There is little overlap between harlequin duck habitat and areas at risk of weed infestation. Therefore, they would not be affected by this project and will not be discussed further in this document.

Management Indicator Species (MIS)

Management Indicator Species (MIS) are species whose habitat is most likely to be affected by forest management activities and serve as indicators of change for threatened or endangered species, big game species, or certain habitat types (USFS, 1987, page II-18). There are five terrestrial MIS for the Gallatin National Forest, several of which are discussed elsewhere in this document. Grizzly bears and bald eagles are indicators for threatened and endangered species, and were discussed under the Threatened, Endangered, and Proposed Species section. The goshawk is a Northern Region sensitive species as well as an indicator for old growth dependent species on dry Douglas fir sites, and was discussed under the Sensitive Species section.

Elk are indicators for big game species. Elk are a highly adaptable species that annually use a wide variety of habitats including open sagebrush and grasslands as well as all forest types. Nearly the entire Forest provides habitat for elk during some time of the year. Elk generally summer on National Forest lands in the higher elevation mountain ranges and migrate to winter ranges on National Forest, state, Bureau of Land Management, and private lands in lower elevation valleys. They are capable of grazing or browsing a wide range of plants during

different seasons, but in Montana grasses or forbs are a critical dietary component for much of the year (Nelson and Leege, 1982, page 344-354). Noxious weeds are typically not eaten by elk at all, or are of very low palatability. Important winter ranges for elk normally occur in grassland or sagebrush habitats that are at high risk for weed infestation. Infestations of weeds such as spotted knapweed can lead to 60-90 percent decreases in forage production on winter ranges (Rice *et al.*, 1997, page 628), which would potentially decrease the number of ungulates that winter ranges can support (Trammel and Butler, 1995, page 814). Elk populations on the Forest are currently at or above objectives set by the Montana Department of Fish, Wildlife, and Parks (MDFWP) with the exception of the Upper Gallatin herd, which has been below the objective for several years (Cherry, 2002).

Pine martens, also known as American martens, typically utilize late-successional mesic conifer stands (Ruggiero *et al.*, 1994, page 7), although in southwest Montana they also use other coniferous habitats such as lodgepole pine and are not restricted to old growth forest stands (Coffin, 1994, page 73). Although their distribution is broad in western North America, ranging from northern New Mexico to arctic Alaska, they are only associated with montane coniferous forests in the Rocky Mountains (Ruggiero *et.al.*, 1994. p.7). They prefer stands with complex structures near the ground (Ruggiero et al., 1994, page 7) including dense herbaceous growth and deadfall (Kujala, 1993, page 28). They may utilize talus areas above treeline, but are normally not found in open rangelands below the lower elevational limit of trees (Ruggiero *et al.*, 1994, page 7). For this reason, there is little overlap between pine marten habitat and areas at risk of weed infestation. The exception is orange hawkweed, which can invade closed-canopy forests and is currently known to occur on one 20-acre site on the Forest. Because its distribution is so limited, treatments of orange hawkweed are not expected to occur within the next 10-15 years on a scale that could affect martens or their habitat. Therefore, martens will not be discussed further in this report.

Migratory Birds and Biodiversity

An executive order signed by President Clinton on January 10, 2001 requires the Forest Service and other federal agencies to evaluate the effects of agency actions on migratory birds. Additionally, migratory birds have a variety of life history strategies that tie in a wide variety of other plant and animal species. Therefore, they were used to assess biodiversity for this analysis. Numerous species of migratory birds seasonally inhabit a variety of habitats across the Forest. The Draft Montana Bird Conservation Plan (Casey, 2000) identified priority bird species for conservation within various habitat types. Birds were ranked according to priority for conservation. Level 1 birds were those with declining population trends and thought to require conservation action; level II birds were those with lesser threat or stable populations but as a minimum require more monitoring; and level III were those that were of local concern but not in imminent risk. Nine species occurring during the breeding season on the Forest in grassland or sagebrush steppe habitats that are most susceptible to weed invasion were listed as level I-III conservation priority (Table 3-13). Numerous other species of birds occur in these habitats as well.

Table 3-13. Priority birds species for conservation occurring on habitats most at risk for weed infestations on the Gallatin National Forest, from the Draft Montana Bird Conservation Plan (Casey, 2000, pages 33-81)

Habitat Type	Species	Priority Rank
Grasslands	Sprague's Pipit	I

Habitat Type	Species	Priority Rank
	Ferruginous Hawk	II
	Long-billed Curlew	II
	Northern Harrier	III
	Short-eared Owl	III
	Bobolink	III
Sagebrush Shrubsteppe	Loggerhead Shrike	II
	Brewer's Sparrow	II
	Lark Sparrow	III

The ecology of the species listed in Table 3-13 is representative of many migratory birds found in grassland and sagebrush habitats. All of the species listed in Table 3-13 nest on the ground or in low shrubs or trees, and are dependent on native vegetation to provide adequate nesting cover. These species also depend upon native vegetation to provide forage plants or cover for prey. Ferruginous hawks, northern harriers, and short-eared owls eat mainly mice, voles, and a variety of other small mammals, birds, and reptiles (Degraff, 1991, pages 76, 90, 203). Loggerhead shrikes prey on a variety of insects, mammals, birds, and reptiles (Degraff, 1991, page 373). Brewer's sparrows, bobolinks, lark sparrows, and sprague's pipits forage on insects and plant seeds (Degraff, 1991, pages 466, 470, 496). Noxious weeds were listed as a threat for species inhabiting both grasslands and sagebrush shrubsteppe habitats (Casey, 2000, pages 37, 67).

Herbicide Toxicity to Terrestrial Mammals and Birds

Exposure of terrestrial animals to herbicides may result from several actions including direct spray application, ingestion of plants or other items that have been sprayed, grooming, and indirect contact with vegetation that has been sprayed or inhalation of spray (Durkin, 2001, page 4-13). Wildlife may spend long periods in contact with contaminated vegetation (Durkin, 2001, page 4-16), or ingest contaminated vegetation or prey (Durkin, 2001, page 4-17).

Pesticides have been identified as a major cause of mortality for numerous species. Organophosphorus and carbamate insecticides are currently the chemicals most commonly associated with mass mortality of wildlife, especially migratory birds (Vyas, 1999). The herbicides proposed for use on the Gallatin National Forest (Table 3-14) are made up of different chemical compounds (phenosyaliphatic acids ,triazoles, bensoics, and phosphonomethyl). The effects of many herbicides on mammalian and avian wildlife have not been studied in detail, although most herbicides have been tested on laboratory animals (especially rats, mice, rabbits, and dogs). Findings are then extrapolated to wildlife (USFS, 1992, page III-F-1), which means that conclusions regarding the effects of these chemicals on wildlife are somewhat uncertain. However, risk levels for herbicide use are calculated in a very conservative manner and worst-case exposure scenarios have been studied for most herbicides. Lethal Dose 50 (LD50) values are used as a measure of toxicity and are defined as the quantity of chemical per unit body weight that would cause lethal effects in 50 percent of a study population with a single dose. Reported LD50 values for herbicides were sometimes highly variable (Table 3-14), reflecting differences among studies such as use of different species or exposure techniques, varying sample sizes, etc. Despite this variability in LD50's, data is sufficient to determine that the herbicides proposed for

use under the Proposed Action are generally of low toxicity to mammalian and avian wildlife (Table 3-14). Exposure to extremely high levels of most herbicides through direct ingestion or spraying during laboratory studies often lead to death or a variety of sub-lethal toxic effects including damage/irritation to the nervous system, kidneys, eyes, skin; inhibition of reproduction; and other problems. However, the doses required to produce such effects were much higher than those wildlife would encounter from application of herbicides in the field even under worst-case scenarios.

In addition to the active ingredients in chemicals used for weed control, commercial herbicide formulations contain various inert ingredients. These ingredients have been placed in four categories by the Environmental Protection Agency according to their toxicity (Moore, 1987). The categories are: 1) inerts of toxicological concern; 2) potentially toxic inerts/high priority for testing; 3) inerts of unknown toxicity; and 4) inerts of minimal concern. The majority of inerts are currently in category 3, indicating that there is a large degree of uncertainty regarding the effects of inert ingredients. Also largely unknown are the possible synerginistic effects of various inert ingredients and pesticides.

The long-term fate of herbicides in the environment is also a concern. Bioaccumulation is the process by which chemicals enter the food chain from the environment, whereas bio-magnification is the increase in concentration of these chemicals from one link in the food chain to the next. The combined effects of these processes means that small concentrations of chemicals can lead to toxic effects, especially for organisms high in the food chain. However, for bio-magnification to occur, the chemical must be long-lived, mobile, and fat-soluble. If a chemical is not long-lived, it will break down before entering the food chain. If it's not mobile, such as when it's bonded to soil, it is unlikely that it could be taken up by an organism. If it is water-soluble rather than fat-soluble, it will be excreted by the organism. The herbicides proposed for use in this project (Table 3 - 14) appear to be rapidly excreted (USFS, 1992;1998a, page 3-7; 1999, page 3-5; 2001, page 3-6) and do not accumulate in tissues, although data was often limited. Because of this, these herbicides present a low risk for bio-magnification.

Table 3-14. Toxicity of herbicides proposed for use on the Gallatin National Forest.

Chemical name (common brand names)	Mammalian toxicity (LD50 in mg/kg body weight)	Avian Toxicity (LD50 in mg/kg body weight)	Risk Assessment
2,4-D (amine form) (Hi-Dep, Weedar 64, Weed RHAP A-4D, Weed RHAP A)	[1]moderate (639 >5,000) [2]low /moderate (100-1800)	[1]low/moderate (472->2,000) [2]low/moderate (300-5,000)	Good data for mammals and birds; birds somewhat less sensitive than mammals; exposure not expected to cause observable adverse signs of toxicity but may lead to eye or skin irritation; exposure at higher than expected levels also affects kidneys, nervous system, and thyroid and may lead to vomiting, diarrhea, and muscle twitches.
Chlorsulfuron (Telar)	[1]nearly nontoxic (<5,000) [3]very slightly toxic (5,545)	[1]nearly nontoxic (<5,000) [3]very slightly toxic (>5,000)	Most data are from experimental mammals, there is some uncertainty about extrapolating conclusions to wildlife; potential for adverse effects to mammals and birds appears to be remote.
Clopyralid	[1]low (none given)	[1]low (none given)	Well studied in experimental

Chemical name (common brand names)	**Mammalian toxicity (LD50 in mg/kg body weight)**	**Avian Toxicity (LD50 in mg/kg body weight)**	**Risk Assessment**
(Stinger, Reclaim, Transline)	2low (>3,000-5,000)	2low (1,465)	mammals but not birds or other wildlife; potential for adverse effects to mammals and birds appears to be remote, given available data.
Dicamba (Banvel, Banex, Trooper)	1slightly toxic (566-3,000) 2low (600->3,000)	1nearly nontoxic (673-2,000) 2low (none given)	Most data are from experimental mammals, there is some uncertainty about extrapolating conclusions to wildlife; toxic effects unlikely for application rates at or above those normally used.
Glyphosate (Roundup, Rodeo, Accord)	1nearly nontoxic (none given) 2low (1,500->5,000)	1nearly nontoxic (3,850) 2low (1,500->5,000)	Good data on mammalian and avian wildlife; toxic effects very unlikely even at highest allowable application rates.
Hexazinone (Velpar, Velpar ULW, Velpar L, Pronone 10G)	1nearly nontoxic (none given) 2low (none given)	1nearly nontoxic (3,850) 2low (2,258)	Most data are from experimental mammals, there is some uncertainty about extrapolating conclusions to wildlife; available data indicate it is unlikely to cause adverse effects to terrestrial species; ingestion of crystals by birds immediately after application may cause reproductive effects or overt signs of toxicity.
Imazapyr (Arsenal, Chopper, Contain)	1nearly nontoxic (4,800-5,000) 2low (none given)	1nearly nontoxic (<2,150) 2low (none given)	Most data are from experimental animals, there is some uncertainty about extrapolating conclusions to wildlife; little data on toxic levels; sufficient data are available to conclude that adverse effects to terrestrial species are unlikely under typical or worst-case cases of exposure.
Metsulfuron methyl (Escort, Ally)	1nearly nontoxic (none given) 2low (>2,000)	1nearly nontoxic (<2,150) 2low (>2,000)	Most data are from experimental mammals, there is some uncertainty about extrapolating conclusions to wildlife; sufficient data are available to conclude that adverse effects to terrestrial species are unlikely under typical or worst-case cases of exposure; may cause weight loss at sub-lethal doses.
Picloram (Tordon, Grazon, Access, Pathway)	1low (<950-8,200) 2low (3,000-5,000)	1nearly nontoxic (<2,000) 2low (>2,000)	Most data are from experimental mammals, there is some uncertainty about extrapolating conclusions to wildlife; adverse effects to mammals or birds are unlikely under typical or worst-case cases of exposure.
Imazapic	2low (none given)	2low (none given)	Most data are from experimental

Chemical name (common brand names)	Mammalian toxicity (LD50 in mg/kg body weight)	Avian Toxicity (LD50 in mg/kg body weight)	Risk Assessment
			mammals, there is some uncertainty about extrapolating conclusions to wildlife; larger mammals affected more than smaller, however adverse effects to mammals or birds are unlikely under typical or worst-case cases of exposure.
Sulfometuron mthyl (Oust)	[1]low (<5,000 *ppm*) [2]low (none given)	[1]low (<5,620 *ppm*) [2]low (none given)	Very limited data on birds; observable effects to most mammals & birds not expected; possible reproductive effects to some species although evidence is not conclusive.
Triclopyr (Garlon, Grazon)	[1]slightly toxic (310-713) [2]low (none given)	[1]very low (1,698) [2]low (none given)	Good data for birds and mammals; application rates at or above those normally used not expected to affect terrestrial animals.

Data are from [1]*Pesticide Fact Sheets* (PFS), Information Ventures, Inc. (http://infoventures.com/e-hlth/pesticides), [2]*Human Health and Ecological Risk Assessments* (ERA), Syracuse Environmental Research Associates, Inc. (http://www.fs.fed.us/foresthealth/pesticide/risk.htm), [3]Risk Assessment for Herbicide Use in Forest Service Regions 1, 2, 3, 4 and 10 on Bonneville Power Administration Sites, LABAT-ANDERSON, Inc. 1992.

WILDERNESS AND INVENTORIED ROADLESS AREAS

Wilderness Areas are areas of Federally owned land that have been designated by Congress as Wilderness, in accordance with the Wilderness Act of 1964. These areas are protected and managed so as to preserve their natural conditions which (1) generally appear to have been affected primarily by forces of nature with the imprint of man's activity substantially unnoticeable; (2) have out standing opportunities for solitude or a primitive and confined type of recreation; (3) have at least 5,000 acres or is of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition; and (4) may contain features of scientific, educational, scenic, or historical value as well as ecologic and geologic interest. A Wilderness Study analysis is conducted on candidate areas to determine an area's appropriateness, cost, and benefits for addition to the National Wilderness Preservation System.

Inventoried Roadless Areas (IRAs) are areas identified in a set of inventoried roadless area maps, contained in Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2 dated November 2000, which are held at the national headquarters office of the Forest Service or any subsequent update or revision of those maps.

***Regulatory Framework – Wilderness and Inventoried Roadless Areas*:**

Designated Wilderness is mandated to be administered so that its community of life is untrammeled by man, its primeval character retained and naturally functioning ecosystems preserved (PL 88-577).

Wilderness areas are managed as directed by the Wilderness Act of 1964. Management actions within Wilderness focus on maintaining naturally functioning ecosystems, providing access through appropriate means (typically trails) and managing some pre-existing uses like grazing allotments and outfitter operations. Examples of management activities include trail construction and maintenance, fire suppression or management of naturally ignited fires, removal of existing structures, and noxious weed treatment.

Forest Service Manual (FSM) 2323.26b allows plant control for "noxious farm weeds by grubbing or with chemicals when they threaten lands outside Wilderness or when they are spreading within the Wilderness, provided that it is possible to effect control without causing serious adverse impacts on Wilderness values. FSM 2109.14 (13.4) requires Regional Forester approval of pesticide use in designated Wilderness Areas.

Congress gives no specific direction as to management of noxious weeds in the Montana Wilderness Study Area. It simply states that agencies are directed to manage these areas to "maintain their presently existing Wilderness character and potential for inclusion in the National Wilderness Preservation System". This implies that the natural integrity of ecosystems as they existed in 1977 should be preserved, as well as opportunities for solitude, a sense of remoteness, and a natural appearing environment.

Generic direction for Wilderness Management is found in the Gallatin Forest Plan, page III-10. Specific direction for the Lee Metcalf and Absaroka Beartooth are found in Appendices F1 and F2. Specifically direction relating to management of noxious weeds states:

Absaroka Beartooth

- All feed packed into the Wilderness will either be certified weed free or processed feed.
- Visitors will be encouraged to remove burrs and weed seeds from stock prior to entering the Wilderness. This will be accomplished through brochures and at trailheads.
- Develop a program of noxious weed control.

Lee Metcalf

- Non-native plants, especially those which may significantly alter natural plant succession, will be controlled as needed, by means that have the least impact on the Wilderness resource. Chemical weed control projects will not commence before a plan for weed control is reviewed by the public. Any use of chemicals must be approved by the appropriate agency officer.
- Use of certified weed free feed will be required by 1988.
- Monitoring of vegetation condition will be conducted.

Inventoried Roadless Lands: There is currently no specific congressional oversight of inventoried roadless lands. Weed treatments on inventoried roadless lands would not need special approval simply because of the area's roadless status.

Affected Area – Wilderness and Inventoried Roadless Areas

The analysis area for wilderness and inventoried roadless areas is the extent of the individual wilderness area and/or roadless area.

Analysis Method – Wilderness and Inventoried Roadless Areas

Geographic Information System (GSI) spatial data was used to determine the location of Wilderness Areas, Wilderness Study Areas and IRAs relative to the proposed activities in the action alternatives. Existing condition was determined through mapping of known weed infestations from the GIS weed database. Potential types of treatments within these areas were estimated.

Management activities (proposed, and past, present and reasonably foreseeable) were evaluated for their potential effects on the Wilderness attributes listed in the Forest Service Northern Region "Our Approach to Effects Analysis" for assessing the impacts on Wilderness and roadless characteristics. This method will be used for designated Wilderness, Wilderness Study Areas, and Inventoried Roadless Areas. The attributes include: natural integrity, apparent naturalness, remoteness and solitude, management, and boundaries. Natural integrity is the extent to which long-term ecological processes are intact and operating. Apparent naturalness is a measure of how natural the environment appears. Impacts to natural integrity and apparent naturalness are measured by the presence and magnitude of human induced change to an area. Solitude is a personal subjective value defined as isolation from the sights, sounds and presence of others, and the developments of man. Management and boundaries will not be affected by proposed activities and will not be discussed further.

Affected Environment – Wilderness and Inventoried Roadless Area

The Gallatin National Forest is largely comprised of designated Wilderness, Wilderness Study Areas (WSA), or IRAs. Of the Forest's approximately 1,808,259 acres of public land, over 75 percent of the Forest is within designated Wilderness, WSA, or Inventoried Roadless Areas. See Table 3-15 for the breakdown of acres.

Table 3-15. Summary of area of land in Wilderenss and Roadless Designation.

Total Forest Acres	Absaroka Beartooth Wilderness	Lee Metcalf Wilderness	Hyalite Porcupine Buffalo Wilderness Study Area	Inventoried Roadless (excluding the WSA)
1,808,259	575,771	140,594	155,000	519,000

Absaroka Beartooth Wilderness: Congress designated the Absaroka-Beartooth (AB) Wilderness Area in 1978. It encompasses a total of 943,626 acres. Montana contains 920,343 acres, divided between the Gallatin and Custer National Forest's. The Wyoming portion contains 23,283 acres (located on the Shoshone NF).

The Crow Indians called themselves Apsaalooke, hence the name of the mountain range that, along with Beartooth, characterizes this Wilderness. Active glaciers, sweeping tundra plateaus, deep canyons, sparkling streams, and hundreds of alpine lakes combine to make this one of the most outstanding Wilderness areas in America.

The Absarokas, unlike Beartooth, have ample vegetative cover, including dense forests and broad mountain meadows crossed by meandering streams. Bighorn sheep and mountain goats roam

about the mostly rugged country, along with elk, deer, moose, marmots, coyotes, black bears, wolves and members of a substantial grizzly population. The harsher Beartooths accommodate far fewer animals. Trout reside in many of the lakes and streams in both ranges.

The history of domestic livestock grazing in the Absaroka-Beartooth has played a role in noxious weed distribution throughout this area. At one time, over 300,000 domestic sheep were grazed in the area. There are currently three active allotments in the Absaroka-Beartooth: one sheep, one cattle, and one horse.

Prevention and education has long been an important tactic in preventing the spread of noxious weeds in the Absaroka-Beartooth. Since 1977, all commercial outfitters have been required to use only certified weed free feeds. Since the mid 1990's all users were required to use certified weed free feeds. Educating the public about the weed issue, and vulnerability of weeds in the Absaroka-Beartooth has been a priority for over a decade.

Wilderness managers have been inventorying and monitoring weed populations in the Absaroka-Beartooth for over 20 years. Hand control operations, grubbing, pulling have been used throughout the Wilderness and limited chemical and biological controls have been applied in specific locations (e.g. East Dam Ck. Spotted Knapweed Control Project). Chemical control of weeds has been implemented only through site-specific NEPA (National Environmental Policy Act) decisions in the Absaroka-Beartooth. The following table represents the weed inventory (Gallatin portion only) in the Absaroka-Beartooth at the end of 2002.

Table 3-16. Summary of mapped weed population in the Absaroka-Beartooth.

Plant Name	Polygons Mapped	Acres
Bull Thistle	3	2
Canada Thistle	169	689
Cheat Grass	10	96
Common Tansy	8	0.50
Dalmatian Toadflax	26	4
Houndstongue	118	274
Mullein	1	2
Musk Thistle	27	140
Oxeye Daisy	10	2
Spotted Knapweed	47	43
Sulfur Cinquefoil	1	0.10
Yellow Toadflax	2	0.10

Certainly other infestations of weeds exist in the Absaroka-Beartooth, but this table represents a fairly extensive inventory. Most of the infestations are proximate to trails, disturbed areas, grazing allotments or burned areas.

There are many aggressive weed infestations peripheral to the Absaroka-Beartooth. Notably – there is a significant Oxeye Daisy infestation in the main Boulder drainage, and Dalmatian toadflax in the Gardiner Basin. Spotted knapweed is well established in large populations on the periphery of the Absaroka-Beartooth in the Custer National Forest. These aggressive weeds have the potential to infect the Wilderness, and destroy naturally functioning ecosystems.

Lee Metcalf Wilderness: Congress designated the Lee Metcalf (LM) Wilderness Area in 1983 including a total of 254,288 acres. All of the Wilderness is within the state of Montana on the

Gallatin and Beaverhead Deerlodge (B-D) National Forests, and the Bureau of Land Management (BLM) lands.

This Wilderness consists of four separate units in the Madison Range of Montana, ranging from a huddle of high peaks rising above 10,000 feet and exquisite subalpine meadows, to the arid river Bear Trap Canyon managed by the BLM. The BLM manages all 6,000 acres of the Bear Trap Canyon Unit, a stretch of wild canyon country along the Madison River. This was the BLM's first designated Wilderness. The BLM is actively monitoring and treating weeds in the Bear Trap. (USDI, ND). The Bear Trap Wilderness Weed Management Plan utilized an integrated management approach to weed control, using all appropriate methods or combination of methods of weed control (chemical, biological, cultural and educational methods).

The Monument Mountain Unit lies on the northwest boundary of Yellowstone National Park, an isolated piece of territory rarely visited but rich in wildlife, including a large population of grizzly bears. All 30,000-plus acres lie within Gallatin National Forest.

The 78,000-acre Spanish Peaks Unit encompasses steeply rugged, glaciated peaks rising more than 11,000 feet above scenic cirques and gemlike lakes. This heavily used area, popular with local and regional visitors, hosts a well-developed trail system.

At about 141,000 acres, the Taylor-Hilgard Unit is the largest wilderness unit. It runs along the crest of the Madison Range, with several peaks exceeding 11,000 feet above the Hilgard Basin, with its meadows and lakes surrounded by snowcapped summits.

There has been a long history of domestic livestock grazing in the Lee Metcalf – including sheep, cattle and horses. Currently there is only one active allotment in the Lee Metcalf – the Sage Creek horse allotment located in the Monument Mountain Unit.

For the last ten years, wilderness rangers have been sporadically monitoring weed infestations in the Lee Metcalf (Gallatin portion). The Madison Ranger District and BLM have active weed monitoring programs. Both the Beaverhead-Deerlodge National Forest and the BLM have aggressively been treating weeds within the Wilderness for several years using all methods of control from grubbing/pulling, chemical applications to biological controls. See the BLM's Bear Trap Weed Management Plan (USDI, ND) for further information. Weed infestations in the Gallatin portion of the Lee Metcalf are believed to be light (inconclusive information, since we lack exhaustive weed monitoring data in the Lee Metcalf), while the Beartrap is heavily infested.

Table 3-17. Summary of mapped weed population in the Lee Metcalf.

Plant Name	Polygons Mapped	Acres
Houndstongue	1	5
*****Poorly Inventoried		

Populations of Canada thistle and other weeds likely exist within the Gallatin portion of the Lee Metcalf. However, weed inventories of the area limited. General observations suggest that most of the serious weed threats occur just outside of the Wilderness at trailheads and on surrounding National Forest. Species present in the nearby Beartrap unit of the Lee Metcalf include: Canada thistle, leafy spurge, spotted knapweed, sulfur cinquefoil, houndstongue, musk thistle, common mullein, and black henbane.

Hyalite Porcupine Buffalo Horn (HPBH) Wilderness Study Area: The Montana Wilderness Study Act of 1977 (P.L. 95-150) created eight Wilderness Study Areas in Montana, of which the Hyalite Porcupine Buffalo Horn was one. This study area is located in the roadless core of the Gallatin Range, running north to Hyalite Canyon, and south to the Yellowstone National Park boundary. In the early 1980's the Forest Service studied the areas' suitability for inclusion in the Wilderness preservation system, and did not recommend that it be designated Wilderness at that time. Checkerboard ownership was largely responsible for the conclusion that the area was unsuitable for future Wilderness designation. Since then, nearly 37,000 acres of private land have been acquired within the Hyalite Porcupine Buffalo Horn boundary.

Weed monitoring has been infrequent and recent in the Hyalite Porcupine Buffalo Horn. The following table represents current data (most of the monitoring has occurred on the Livingston Ranger District – eastern portion of the study area):

Table 3-18. Summary of mapped weed population in the Hyalite Porcupine Buffalo Horn Wilderness Study Area.

Plant Name	Polygons Mapped	Acres
Canada Thistle	10	34
Houndstongue	13	14
Mullein	3	4
Musk Thistle	5	0.5
Oxeye Daisy	1	0.10
Pennycress	1	0.10
Spotted Knapweed	1	0.10
White Top, Hoary Cress	1	0.10
Yellow Toadflax	1	0.10

Inventoried Roadless Lands**:** Approximately 674,000 acres of inventoried roadless in 12 separate areas are located on the Gallatin National Forest. The inventory was displayed in the Gallatin Forest Plan EIS, Appendix C (USDA, 1987). In the late 1990's the Clinton Administration completed a nationwide study of "roadless" lands on public land, and maps of record included in the final rule (USDA, 2001). The final rule acknowledges that this inventory may not be perfectly accurate, and likely included lands which no longer retained their roadless characteristics. Inventoried roadless lands are found in all the mountain ranges on the Gallatin National Forest, and are currently allocated a wide variety of Forest Plan Management Area designations from the most protective (MA 4 – recommended Wilderness) to allocations focusing on timber or range management. A wide variety of land uses occur within these areas, from range allotments and minor mineral developments to dispersed recreation use of trails and trail-less areas.

The following table summarizes weed inventory data collected at the end of 2002 for inventoried roadless lands on the Forest:

Table 3-19. Summary of mapped weed population in the Inventoried Roadless Area.

Plant Name	Polygons Mapped	Acres
(Diffuse) White Knapweed	6	1
Bull Thistle	28	22
Canada Thistle	163	221

Plant Name	Polygons Mapped	Acres
Cheat Grass	63	895
Common Tansy	20	1
Dalmatian Toadflax	33	1091
Golden Chamomile	4	2
Houndstongue	169	305
Leafy Spurge	34	95
Mullein	1	0.10
Musk Thistle	48	49
Oxeye Daisy	27	13
Poison Hemlock	2	0.10
Spotted Knapweed	158	105
St. John's Wort	6	10
Sulfur Cinquefoil	2	0.10
White Top, Hoary Cress	2	0.10
Yellow Toadflax	16	69
Field Scabious	2	0.10

WILD AND SCENIC RIVERS

Regulatory Framework – Wild and Scenic Rivers

The Wild and Scenic Rivers Act (16 US1271) and Interagency Guidelines provided in the Wild and Scenic Rivers Reference Guide (USDA and others, 1995) provide the general direction for management of these rivers. Additional goals, guidelines, and standards are found in the Gallatin Forest Plan as amended by amendment #12. The Gallatin Forest Plan provides a goal to "Manage the eligible Wild and Scenic Rivers to protect their outstandingly remarkable values." A standard states that "Management activities will comply with the standards for Wild and Scenic Rivers from Chapter 8 of the Forest Service handbook 1909.12."

Analysis Area – Wild and Scenic River

The analysis area for Wild and Scenic Rivers are those streams and adjacent lands within the Gallatin National Forest that are currently listed for protection under the Wild and Scenic Rivers Act.

Analysis Method – Wild and Scenic Rivers

The source of information for the Affected Environment was the Forest Plan and its associated EIS. The analysis is based on the potential for the proposed weed treatment activities to impact the values inherent to rivers or streams on the Gallatin National Forest that are potentially eligible for protection under the Wild and Scenic Rivers Act.

Affected Environment - – Wild and Scenic Rivers:

Portions of four streams were identified as "eligible" for Wild and Scenic River designation during the Gallatin Forest Plan (USDA, 1987). Those included the Madison, Gallatin, Yellowstone and Boulder Rivers. One additional segment was added to that list in a Forest Plan Amendment (#12) in 1993- the Clarks Fork of the Yellowstone. See the Forest Plan – appendix J

for a complete description of the eligible segments of these streams. None of these segments of river have been designated by Congress as Wild and Scenic to date.

The Wild and Scenic Rivers Act was enacted to preserve in a free-flowing condition rivers which possessed outstanding scenic, recreational, geologic, fish and wildlife, historic cultural or other similar values. Congress declared that is was important to manage certain rivers in their free flowing condition, and to manage them and their immediate environment to protect those qualities for the benefit and enjoyment of present and future generations. The presences of weeds along the river corridor can detract from the aesthetic and recreational opportunities. The eligible river segments are assigned a potential classification of wild, scenic, or recreational. Characteristics of these classifications are:

- Wild River areas -free of impoundments, generally accessible only by trail, shorelines primitive and the water unpolluted;
- Scenic River areas - free of impoundments, shorelines largely undeveloped but accessible in places by road;
- Recreational River areas –readily accessible by roads, some development and may have impoundment or diversion.

Madison River – approximately eight miles of this river located within the Gallatin National Forest is considered eligible. Outstandingly remarkable values identified included the geologic features associated with the earthquake of 1959, a blue ribbon trout fishery, nesting bald eagles and osprey, and outstanding recreation opportunities. It is considered eligible under a "recreation" classification.

Gallatin River – approximately 39 miles of the river is located within Gallatin National Forest boundaries. The outstandingly remarkable values identified included scenery, blue ribbon trout fishery, and recreation. It is considered eligible under a "recreation" classification.

Yellowstone River – approximately 16 miles of the Yellowstone River are located within the Gallatin National Forest boundary. The outstandingly remarkable values identified for the Yellowstone included its recreation and scenic qualities. An important trout fishery was also noted. It is considered eligible under a "recreation" classification.

Boulder River – approximately 28 miles of this river are within the Gallatin National Forest boundaries. Outstandingly remarkable values identified included the unique geologic features of the Natural Bridge, recreational, and scenic values. It is considered eligible under a "recreation" classification.

Clarks Fork of the Yellowstone - approximately 1.8 miles of this stream fall within the Gallatin National Forest boundary. Outstandingly remarkable values identified included the unique geologic features of the Beartooth Plateau, and high recreation values. This addition was made partially because a lower section of this river in Wyoming was classified as designated a Wild and Scenic River in the late 1980's.

RESEARCH NATURAL AREAS

Regulatory Framework – Research Natural Areas

Reasearch Natural Areas (RNAs) and Special Interst Areas (SIAs) are managed to maintain the undisturbed conditions and natural processes that characterize these areas. At the time the Gallatin Forest Plan was signed, there were no areas formally designated as RNAs or SIAs although nine areas were identified for designation based on their representative and/or unique natural and ecological features. The Forest Plan was amended in 1997, formally designating seven RNAs and one SIA on the Gallatin National Forest. They include the East Fork Mill Creek RNA, Passage Creek RNA, and Sliding Mountain RNA on Livingston Ranger District; the Palace Butte and Wheeler Ridge RNA on Bozeman Ranger District; and the Black Butte RNA, Obsidian Sands RNA and Black Sands Springs SIA on Hebgen Lake Ranger District.

The Code of Federal Regulations (CFR) provides management direction as follows "Forest Planning shall provide for the establishment of RNAs" (36 CFR 219.25) and "[RNAs] will be retained in a virgin or unmodified condition except where measures are required to maintain a plant community which the area is intended to represent" (36 CFR 251.23). The Forest Service Manual (FSM) also provides guiding management direction for RNAs (FSM 4063) and SIAs (FSM 2372). In addition, the individual establishment records for each area serves as Forest Plan direction (as amended).

Applicable to invasive species management, FSM 4063.3.8, 9 directs activities to comply with the following standards: *8) Where pest management activities are prescribed, they shall be as specific as possible against target organisms and induce minimal impact to other components of the ecosystem, and 9) If practicable, remove exotic plant or animal life.* Further, FSM 4063.32 directs that "*If exotic plants or animals have been introduced into an established RNA, the Station Director and the Regional Forester shall exercise control measures that are in keeping with established management principles and standards to eradicate them, when practical.*"

Lastly, FSM 4063.34 [in part] "*Use only tried and reliable vegetation management techniques and then apply them only where the vegetative type would be lost without management. The criterion here is that management practices must provide a closer approximation of the naturally occurring vegetation and the natural processes governing the vegetation than would be possible without management. Unless the manager is certain that the management practice will meet this criterion, do nothing.* Responsibility for management of RNAs is shared between the National Forest System and the Forest Service Rocky Mountain Research Station. The Regional Forester, with concurrence of the Research Station Director, has the authority to establish RNAs and approve research and monitoring activities. FSM 4063.34 continues, "*The Station Director, with the concurrence of the Forest Supervisor, may authorize management practices that are necessary for noxious weed control or to preserve the vegetation for which the research natural area was created. These practices may include grazing, control of excessive animal populations, or prescribed burning.*"

While the list of practices does not mention herbicides, chemical control methods may be used in RNAs as long as it meets the vegetation management criterion, according to Regional RNA Coordinator, Steve Shelly. Concurrence of the Research Station Director and the Forest Supervisor is required for management actions, including proposed control methods that would involve herbicide use in established RNAs (Shelly, personal communication).

The Decision Notice establishing the RNAs selected an alternative that included this direction: "*Procedures permitted for control of noxious weeds and use of herbicides are described in FSM 4063. Generally, the broad application of herbicides within RNA/ SIA would not be allowed. Actions would be taken to prevent introduction of noxious weeds to RNAs and SIAs*." In addition, no motorized access is permitted (with few exceptions) in RNAs and only limited motorized access is permitted in Black Sands SIA.

The establishment records for all of the RNAs and SIAs also state "*Pest management and noxious weed control will be as specific as possible against target organisms and induce minimal impact to other components of the area… If invasive exotics are discovered within the RNA, measures will be taken to control or eradicate these populations.*" Relative to some RNAs within designated wilderness areas is the direction that "*Management of the RNA will be compatible with and consistent with Wilderness management direction*."

Analysis area – Research Natural Areas

The analysis areas for RNAs and SIA are the RNAs and SIA themselves. The focus of the analysis will be those RNAs or SIA that currently have some level of weed infestation as identified in the Affected Environment Section.

Analysis Method – Research Natural Areas

Information for the Affected Environment came from the Establishment Records for the individual RNAs and SIA, which were completed in 1997, and current GIS and weed inventory data. The analysis is based on the effect the proposed activities in each alternative would have on the establishing criteria for each RNA and SIA, and potential for affecting ecological integrity.

RECREATION

Regulatory Framework – Recreation

The goal of the Gallatin National Forest Plan (1997) relative to recreation is to provide a broad spectrum of recreation opportunities in a variety of Forest settings. The Forest Service Manual, FSM 2300, describes the Forest Service Authority, Objectives, Policy, and Responsibility for recreation management. Pertinent Federal Laws are the Forest Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act, and the Wilderness Act of 1964.

Analysis Area - Recreation

The analysis area for recreation analysis is confined to all developed and non-developed recreation sites on the Gallatin National Forest.

Analysis Method - Recreation

The source of information for the Affected Environment was the Forest Plan and its associated EIS. The analysis is based on the potential for proliferation of invasive weeds if left untreated, and proposed weed treatment activities to impact recreational opportunities on the Gallatin National Forest.

Affected Environment - Recreation

Invasive weeds can affect the recreation experience. Invading weeds such as spotted knapweed, thistles, toadflax, leafy spurge, houndstongue, and oxeye daisy detract from the desirability of using recreation sites and enjoyment of the forest environment. These species diminish the usefulness of sites because the stiff plant stalks, thorns, or toxic sap can discourage or prevent walking, sitting, or setting up a camp. Invasive weeds also detract from the recreation experiences by reducing the variety and abundance of native flora to observe or study and reducing forage availability for wildlife and recreational livestock.

Weeds are frequently spread through recreational activities, particularly along roads, trails, campgrounds, and dispersed recreation sites. The Gallatin National Forest provides a variety of recreational experiences including camping, hiking, hunting, fishing, mountain biking, snow-mobiling, horseback riding, skiing, and driving for pleasure. Passenger vehicle roads provide primary transportation routes into and through out the Forest. While these roads provide access for a variety of purposes (commercial, residential, administrative), the primary public benefit may be for recreational purposes. Controlling weeds along roads and recreational sites will reduce the tendency for recreational activities to spread weeds into adjacent areas.

The issue of effects of herbicides on human health is treated separately in this analysis. Please refer to the human health issue in Chapters 3 and 4 for more information.

HUMAN HEALTH

Regulatory Framework - Human Health

Safety standards for herbicides use are set by the Environmental Protection Agency, Occupational Health and Safety Administration, Code of Federal Regulations (40 CFR part 170), and individual states. In addition, several sections of the Forest Service Manual (FSM, 1994) provide guidance to the safe handling and application of herbicides. These include:

- Preparation of a safety plan for all pesticide use projects (FSM 2150);
- Consultation of pesticide handlin g requirements set forth in the Forest Service Health and Safety Code Handbook (FSM 6709.11) and (FSM 2156);
- Pesticide-Use Management and Coordination Handbook that requires the Forest to review pesticide use proposals in terms of human health (FSM2109.13.2);
- Recommendation to complete risk assessments prior to pesticide use to ensure public safety (FSM 2109.14);
- Completion of project work plans prior to implementation, including a description of personal protective clothing and equipment required (FSM 2109.14.3);
- Safety planning the requires development of a safety plan to protect the public and employees from unsafe work conditions when pesticides are involved (FSM 2109.16, FSM 2153.3);
- Safety and Health Hazard Analysis that requires completion of a Job Hazard Analysis (Form FS-67007-7) to determine hazards on the project and identify ways to eliminate them (FSM 2109.16.2, FSM 6700, FSH 6709.11).

Finally, FSM 2109.16.3 states the requirement for, and defines Pesticide Risk Assessment as "Another method of helping to ensure safety in pesticide use is to conduct risk assessments. Analyses estimate the possible pesticide dose to workers and the public who may be affected by a pesticide application; and the potential effects on fish, wildlife, and other non-target organisms.

These estimated doses are then compared with levels of no observed effects based on tests of laboratory animals."

These analyses are usually incorporated into the decision making documents prepared in compliance with the National Environmental Policy Act (FSM 1950). A pesticide risk assessment does not, in itself, ensure safety in pesticide use. The analysis must be tied to an action plan which provides mitigation measures to avoid potential risks identified by the risk assessment.

Affected Area - Human Health

The analysis area is confined to the Gallatin National Forest boundary. Effects are related both to the impacts of weeds on humans and the impacts of weed control. For weeds, concerns are related to the impacts from exposure to pollens and plant chemical. For weed control, concerns are related to the exposure to toxicant found in the herbicides used in ground and aerial applications.

Analysis Method - Human Health

The effects analysis compares the application rates, location and timing, and mitigation measures specified in Chapter 2 with scientific literature on toxicity and risks. The review of the effects of herbicide application in this document includes possible pesticide doses workers and the public may receive, and are compared to levels of no observed effects.

Affected Environment- Human Health

The Forest Service contracted with Information Ventures, Inc. to summarize ecological and toxological data and human health effects based on Environmental Protection Agency (EPA) studies. Toxicity information for herbicides was reviewed to determine the levels of these chemicals that would be harmful to human health. Potential exposures and doses are estimated for workers and the general public. Toxic effect levels are compared to predicted dose levels to determine the possibility of human impact.

Considerable data from tests on laboratory animals is available for the herbicides proposed for use with this project. All herbicides proposed for use on the Gallatin National Forest are EPA approved and have assigned registration numbers.

All herbicides proposed for use have been subjected to long-term feeding studies that test for general systemic effects such as kidney and liver damage. In addition, tests of effects on reproductive systems, mutagenicity (birth defects), and carcinogenicity (cancer) have been conducted.

Pesticides are not risk-free. The reason EPA allows the use of products with the potential to cause toxicity is that, "when used according to label instructions"; the risks of the pesticide are outweighed by the benefits. Reading and following instructions on labels is the best way to insure personal safety. Toxicity tests required by EPA for pesticide registration include "Acute" (short term) or "Chronic" (longer Term) exposures.

Acute toxicity can be a function of the amount of toxicant received, the route of administration, and the type of animal tested. Acute reactions tested include: oral dermal and inhalation toxicity, acute delayed neurotoxicity, eye and dermal irritation, and dermal allergic sensitization. Tables 3-20 and 3-21 display acute toxicity categories for the proposed herbicides.

Chronic toxicity results from prolonged, repeated or continuous exposure to a chemical, typically at levels lower than necessary to cause acute toxicity. It often demonstrates a delayed response. Public concerns toward herbicides generally focus on potential chronic toxicity. Sublethal poisoning or exposure may be expressed by any of the following: skin/eye irritation; nervous system disorders; reproduction system disorders; damage to other organ systems (liver, kidney, lungs, etc.); birth defects; mutations; and cancer.

The EPA evaluates carcinogenicity, teratology (birth defects), and mutagenicity study results of herbicide effects to animals during the herbicide registration process. The study data is used to make inferences relative to human health. From these studies, chronic toxicity of herbicides proposed for use on the Gallatin National Forest can be summarized. Table 3-22 compares chronic effects between various herbicides.

Concerns have been expressed by the public, as to the potential for adverse health effects, from contacting or consuming treated vegetation, water, or animals. Harmful effects from this type of exposure are low for most of the herbicides being proposed for this project. "The exposure levels a person could receive from these sources, as a result of routine operations are below levels shown to cause harmful effects in laboratory studies." (Information Ventures, 1995), Exceptions are 2,4-D, Hexazinone, Sulfometuron Methyl, and Glyphosate.

Hexazinone: "To prevent residues of hexazinone in meat or milk, do not graze domestic animals on treated areas within 30 days after treatment."

2,4-D: "To keep residues of 2,4-D out of meat or milk, do not graze dairy cattle on treated areas for seven days after application. Do not cut hay for 30 days and do not slaughter meat animals for three days. Contact with dried residues on vegetation is not expected to be hazardous."

Sulfometuron Methyl: No reports of acute poisoning in humans have been found. No reports of chronic poisoning in humans have been found.

Glyphosate: Most incidents reported in humans have involved skin or eye irritation in workers after exposure during mixing, loading or application of glyphosate formulations. Nausea and dizziness have also been reported after exposure. Swallowing the Roundup® formulation caused mouth and throat irritation, pain in the abdomen, vomiting, low blood pressure, reduced urine output, and in some cases death. These effects have only occurred when the concentrate was accidentally or intentionally swallowed, not as a result of the proper use of Roundup®. The amount swallowed averaged about 100 milliliters (about half a cup). There are no reported cases of long-term health effects in humans due to glyphosate or its formulations. Glyphosate is sold over the counter at retail stores and would be used on the Forest in limited applications such as aquatic approved formulation near water.

Table 3-20. Toxicity Categories for Various Types of Harmful, Acute Reactions.

Toxicity Category	*Signal Word*	*Oral (mg/kg)*	*Dermal (mg/kg)*	*Inhalation (mg/kg)*	*Eye Irritation*	*Skin Irritation*
I	DANGER Poison	0-50	0-200	0-0.2	Corrosive: corneal opacity **not** reversible within 7 days.	Corrosive
II	WARNING	>50-500	>200-2000	>0.2-2.0	Corneal opacity reversible within 7 days; irritation persisting for 7 days	Sever irritation at 72 hours
III	CAUTION	>500-5000	>2000-20,000	>2.0-20	No Corneal opacity; irritation reversible within 7 days	Moderate irritation at 72 hours
IV	NONE	>5000	>20,000	>20	No Irritation	Mild irritation at 72 hours

Table 3-21. Human Hazards Based on Acute Toxicity Categories. *(Information Ventures Inc., Pesticide Fact Sheet and EXTOXNET, Pesticide Information Profiles, Oregon State University)*

Herbicide	*Acute Oral Toxicity*	*Acute Dermal Toxicity*	*Acute Inhalation*	*Primary Eye Irritation*	*Primary Skin Irritation*
Picloram	Caution	Caution	None	Caution	None
Metsulfuron Methyl	None	Caution	Caution	Warning	Caution
Hexazinone	Caution	None	None	Danger-Poison	None
Clopyralid Methyl	Caution	Caution	Caution	Warning	None
Chlorsulfuron	None	Caution	Caution	Caution	None
Triclopyr	Caution	Caution	Caution	Caution/Danger	Caution
Imazapyr	None	Caution	Caution	Caution	Caution
2,4-D Amine	Caution	Caution	Caution	Danger-Poison	Caution
Dicamba	Caution	None	None	Danger-Poison	None
Glysophate	None	None	Caution	Warning	None
Sulfometuron Methyl	Caution	Caution	Caution	None	None

Table 3-22. Comparison of Harmful Chronic Effects. *("No Effects"= No effects have been shown in laboratory tests and is not considered a hazard to humans. "Unlikely"= Inconsistent or isolated effects have been shown in laboratory tests and it is not considered a hazard to humans at expected exposure levels. "Unknown" = Laboratory tests are inconclusive or further testing is required.)*

	Potential Chronic Effects			
Herbicide Active Ingredient	*Carcinogenic*	*Teratogenic*	*Reproductive*	*Mutagenic*
Picloram	Unknown	No Effects	No Effects	Unlikely
Metsulfuron Methyl	No Effects	No Effects	No Effects	No Effects
Hexazinone	Unlikely	Unlikely	Unlikely	No Effects
Clopyralid Methyl	No Effects	No Effects	No Effects	No Effects
Chlorosulfuron	No Effects	No Effects	No Effects	No Effects
Triclopyr	No Effects	No Effects	No Effects	Unlikely
Imazapyr	Unknown	No Effects	Unknown	No Effects
2,4-D Amine	Unknown	Unlikely	Unlikely	Unlikely
Dicamba	No Effects	No Effects	Unlikely	No Effects
Glysophate	No Effects	No Effects	Unlikely	No Effects
Sulfometuron Methyl	No Effects	No Effects	Unlikely	No Effects

Herbicide Drift

Spray drift is the direct movement of herbicide from the target to areas where herbicide application was not intended. Movement of spray droplets or herbicide vapor causes herbicide drift. Several factors affect spray drift and are defined below, the results of which are summarized in Table 3-23. Incorporating these factors into the project design will reduce the risk of drift.

Spray Particle Size – Spray drift can be reduced by increasing droplet size, since large droplets move less than small droplets in wind. Reducing spray pressure, increasing nozzle orifice size, special drift reducing nozzles, additives that increase spray viscosity, and rearward nozzle orientation, all can increase droplet size.

Method of Application – Herbicide spray drift is generally greater from aerial application than from ground application. Low-pressure ground sprayers generally produce larger spray droplets, which are released from the nozzle closer to the target than with aerial sprayers.

Distance Between Nozzle and Target – Less distance between the droplet release point (the boom arm) and the target reduces spray drift. The spray travels a shorter distance with less opportunity for drift.

Herbicide Volatility – All herbicides can drift as spry droplets, but some are sufficiently volatile to cause plant injury from drift of fumes.

Relative Humidity and Temperature – Low relative humidity and/or high temperature cause more rapid evaporation of spray droplets between the nozzle and target than high relative humidity and/or low temperature. Evaporation reduces droplet size, which in turn increase the potential drift of the spray droplets.

Wind Direction – Herbicides should only be applied when the wind is blowing away from non-target plants.

Wind Velocity – The amount of herbicide lost from the target area and the distance the herbicide moves will increase as wind velocity increase, so greater wind velocity will generally cause more drift.

Air Stability – Horizontal air movement is generally recognized as an important factor affecting drift, but vertically air movement is often overlooked. Vertical stable air (temperature inversion) occurs when air near the soil surface is cooler or similar in temperature to higher air. Small spray droplets can be suspended in stable air, move laterally in a light wind and impact plants downwind.

Spray Pressure – Spray pressure influences the size of droplets formed from the spray solution.

Nozzle Spray Angle – Spray angle is the angle formed between the edges of the spray pattern from a single nozzle. Nozzles with wider spray angles produce smaller spray droplets than those with narrower spray angle at the same delivery rate.

Nozzle Type – Nozzle types vary in droplet sizes produced at various spray pressures and gallons per minute output.

Air Movement around Aircraft – Vortices are irregular drifts of air around the fixed wing of airplanes or the rotary blades of helicopters. The fixed wing or rotor tips produces an updraft, while the body of the aircraft produces a downdraft. Vortices affect the deliver of spray particles accordingly.

Table 3-23. Effects of Drift Factors on Herbicide Drift.

Factor of Drift	More Drift	Less Drift
Spray particle size	Smaller	Larger
Release height	Higher	Lower
Wind Speed	Higher	Lower
Spray pressure	Higher	Lower
Nozzle size	Smaller	Larger
Nozzle orientation	Forward	Backward
Nozzle location	>3/4 wingspan	<3/4 wingspan
Air temperature	Higher	Lower
Relative humidity	Lower	Higher
Nozzle type	Small droplets	Large droplets
Air stability	Stable	Unstable
Herbicide volatility	Volatile	Non-volatile